



He that more of thine *Excellence* would know,
On this thy BOOK let him son e Thoughts bestow.
Deep Questions in *ARITHMETICK* here are
Demonstrated by RULES so Plain, so Rare,
Envy it Self must needs confest thus much,
Read all the Books 'th' World, you'll find None
[Such.

HODDER'S

ARITHMETICK:

OR, THAT

Necessary ART

Made Most Easy;

Being explain'd in a way familiar
to the Capacity of any that de-
sire to learn it in a *little* Time.

By J. Hodder, Writing-Master.

*The Seven and Twentieth Edition, Re-
vised, Augmented, and above a Thousand
Faults Amended,*

By William Hume, Philomath.

L O N D O N :

Printed for D. Midwinter, A. Bettesworth, and
C. Hitch, R. Robinson, A. Ward, J. and
P. Knapton, T. Longman, C. Bathurst, and
J. Clarke, in Duck Lane, 1739. •

To my Ingenious Friend Mr. William
Haute, on his Amendments and Im-
provements to Mr. James Hodder's
Arithmetick, &c.

THIS Critick Age excludes Things Obsolete,
Now nothing takes, wanting a Dress complete.
Beauty, though Unador'd, is Beauty still,
Enrich'd with Splendor captivates each Will.

So be that wou'd care'ss this knowing Age,
And means i' appear in Print upon the Stage,
(E'en in this Harveſt-Time, when Learning,
And Wits are ripe, and the Sublimest Arts,
Are now arriv'd at what they can aspire,
At which Ages to come may well admire)
Muſt emulate what hath been done before,
And muſt thoſe Acquirements, which in ſtore,
Lay dormant. This Thy Pen hath fully done;
Th' haſt added to his Fame, and to thine own,
For amplifying his elaborate Piece,
Multiples thy Worth, not Subſtrating his,
Imbelliſhing the Work, is to create
A laſſing Progeny in ſpite of Fate.
The Author's Mantle doſt envelop Thee;
And when the future grateful Age ſhall ſee,
That by Accompliſhments thou doſt inherit
A double Portion of Great HODDER's Spirit:
Poſterity ſhall ſeeu, how juſtly we Assume,
To prize the Works of HODDER as well; thoſe of
(H U M E.



HODDER.

TO HIS

REALLY LOVING

AND

Most Worthily Honoured

FRIEND,

JOSIAS DEWYE,

Merchant and Citizen

OF

LONDON:

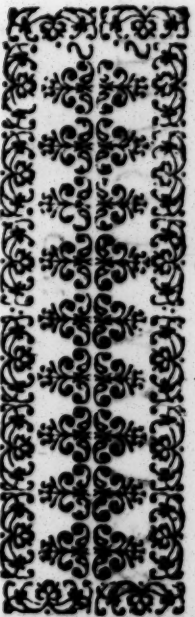
James Hodder,

In Token of True Gratitude
for unmerited Kindnesses,

HUMBLY DEDICATETH

THIS

Manual of Arithmetick.



TO THE

READER.

Having for sundry Years kept a Writing-School in this City and thereby gained some Experience in that commendable Art, I thought good heretofore to publish somewhat thereof.

And now for the better compleating of Youth, as to Clerkship and Trades, I am induc'd to publish this small Treatise of Arithmetick, which, tho' it be dedicated more particularly to my much honoured Friend; yet being assured he can be content that others should partake of the Benefit thereof, I make bold thus to communicate it.

I need not go about to speak any thing in Praise of Arithmetick, but shall willingly submit what is here treated of to the candid Censure of the most judiciously skilful.

And

TO the READER.

And as I shall condemn no Man's Diligence in what he hath formerly done ; so I think none will blame my Endeavours at the present ; for tho' I know it is impossible to please every Man, therefore am not solicitous how to do it ; yet, according to the Ability which God hath given me, I have laboured to make a more clear Discovery of some Intricacies in this Art, than to my Knowledge has hitherto been. Which, tho' perhaps it may not seem to be set out in so gallant a Dress as some others, yet I dare aver to be done with as much Plainness, Facility, and Shortness as any that I have yet observed.

Thus, not fearing, Gentle Reader, least any Man should scorn my Labours, because I seem to undervalue them, by letting others have the Use, Profit, and Pleasure thereof at so small a Rate, I refer myself, and them, to thy Consideration ; and if after Perusal and Trial made, thou kindly acceptest what I lovingly offer, it shall abundantly satisfy him that is devoted to serve God, and profit others in his Calling, and desires to remain,

Ready to pleasure Thee,
Whether known, or unknown to

James Hodder.

The Corrector to the Reader.

Cautious Reader,

THE Esteem this Manual of *Arithmetic* hath Received from the *Learn'd* and *Judicious*, as well as from the Publick in General; are Undeniable Indications of its Worth; Especially when we Consider that this is the *Twenty Seventh Edition* since its first Publication.

Nor can I reasonably and justly Omit, much less deny the Truth of the *AUTHOR'S* Observation; when he Modestly signifies, That tho' the Dress of the Subject is not so Gallant as some others; yet its *Plainness, Facility, and Shortness*, (to which I may now add *Completeness*) is so Obvious, that nothing in so small a *Volume* can either Exceed or Compare with it; seeing it is not only Clear'd from all Intricacy and Obscurity; but also Singularly Adapted to the Capacity of Youth, in Qualifying them, (in some Measure) for *Trades and Professions*, as well as *Clerkships*.

And first, for the Satisfaction of the *Reader*, it may be observed, That some of the Essential Parts, newly Added, are,

I. *Modern-Division*, which is esteem'd one of the Fundamental Parts of *ARITHMETICK*, as well as the most difficult to a *LEARNER*; who ought to be well Instructed in the same, before he proceeds further.

II. *Interest Simple and Compound*; remarkably Illustrated by *Compendium* and *Observations*; to-

gether

The Corrector to the Reader.

gether, with some Useful Remarks upon *Præfice* and other Rules, Occasionally Explain'd and Apply'd.

III. *The Rule of False Position*, both *Single* and *Double*, Apply'd to the *Solution* of several Curious and Useful Questions.

Now albeit in this *Edition* all former Errors are Purged, Intricacies and Obscurities Explain'd, and the Whole so *Improv'd* and *Augmented* that the Industrious LEARNER cannot miss of *Proficiency*, nor the CURIOUS of *Satisfaction*: Yet this doth not Contradict, but that This, as well as other *Essays Arithmetical*, where Figures are so Numerous, must needs be Subject to some *Errors* or *Mistakes* from the Press; which we hope will here be so few and *inconsiderable*, that the Courteous READER, will not be wanting to Correct with his Pen, so soon as discover'd.

In Brief: As the *Whole*, is intended for a Publick Benefit; so we hope, it can neither miss of the LEARNER's Satisfaction, nor even the Approbation of the *Candid* and *Judicious* READER; which is the principal Aim of the *Author* heretof, as well as Him, who is a Lover of Ingenious Arts,

WILLIAM HUME

A TABLE



A TABLE shewing the Contents of this BOOK.

Chap. 1. **T**HE Definition of Numbers and Numeration ; with an Easy Table thereunto belonging.

Chap. 2. Addition of Money, Measures, Weights, &c.

Chap. 3. Subtraction of Money, Measures, Weights, &c.

Chap. 4. Multiplication, with the Use thereof, laid down in a very plain and easy Method, for Young Learners ; never before Extant.

Chap. 5. Division the Common Way, and the Use thereof. Also another kind of Division more brief, Easy and Linéal.

Chap. 6. Modern Division Compendiously Performed three Manners of Ways.

SECT. 1. Division Illustrated and Reduced Easy and Concisely, by the French Method, formerly Used.

SECT. 2. The Italian Way of Division ; Addressing to the English Method.

SECT. 3. Division Exquisitely and Concisely Performed, Or, The Short Italian Method.

Chap. 7. Reduction of Money, Measures, Weights &c. with very Easy Ways to find out the Tare and Net.

Chap. 8. What Fractions are ; How Expressed ; And the several Sorts thereof.

Chap. 9. Reduction of Fractions ; And why Reduction is before Addition.

Chap. 10 Addition of Fractions the Common Way ; and some other Ways more expedient.

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- Chap. 11. Subtraction of Fractions.
 Chap. 12. Multiplication of Fractions.
 Chap. 13. Division of Fractions.
 Chap. 14. The Rule of Three, Direct and Indirect, in Whole Numbers, wrought four several Ways, with a Direction how to Work any Question upon the Rule of Three, without troubling the Head with the Distinction of Direct and Indirect.
 Chap. 15. The Rule of Three in Fractions.
 Chap. 16. Practice, with very Plain and Easy Tables.
 Chap. 17. The Double Rule of Three; consisting of Five Numbers.
 Chap. 18. Very brief Rules for Interest and Interest upon Interest; Also by the help of a plain Table to know what any Sum of Money comes to Interest upon Interest, for 21 Years, or Under, at one Working, by the Rule of Three.
 Another Table to know what an Annuity will Amount unto for the same Time at one Working, by the said Rule
 * Compendiums and Useful Observations upon Interest, both Simple and Compound.
 Chap. 19. The Rule of Fellowship, or Company, without Time; And Fellowship with Time.
 Chap. 20. The Rule of Barter.
 Chap. 21. Equation of Time for Payment of Money.
 Chap. 22. Rebate or Discount.
 Chap. 23. Exchange of Money, from One Country to another; And, To know at what Rate the Exchange is made, either for Money or Wares.
 Chap. 24. Loss and Gain; by which you may know what is gained or lost per Cent. in the Sale of any Commodity, at such a Price; And what it must be Sold for to Gain, or Lose so much per Cent. Likewise having

THE CONTENTS.

having Gain'd or Lost so much per Cent. to know what it Costs.

And having Gain'd so much per Cent. when Sold at such a Price, what shall be Gain'd or Lost, when Sold at another Price.

Chap. 25. Alligation Medial, and Alternate.

Chap. 27. The Rule of False Position, both Single and Double.

Sect. 1. Single Position how Perform'd.

Sect. 2. Double Position, Illustrated and Apply'd.

Chap. 26. Instructions for Measuring of any Surfaces, as Board, Glass, Hangings, Pavement, &c. As also the Measuring Solids, as Timber, Stone, &c.

Sect. 1. Concerning the Mensuration of Board, Glass, &c.

Sect. 2. Instructions for the Measuring of Solids, as Timber and Stone, &c.

N. B. The Reader may here observe, that all these Contents, that hath an Asterisk (viz. *) prefix'd; are newly prepared and Added by the Corrector.

Advertisement.

GRAMMAR, and the Latin Classicks; Writing in all the usual Hands; Arithmetick, in all its Parts; Merchants-Accounts, and Mathematicks, are Carefully Taught in Little-Britain, near St. Bartholomew's-Hospital,

By William Hume.

Persons also Taught Abroad.

To the attaining whereof, observe, that all Numbers are express'd, by these Characters following, whose simple Value by themselves consider'd, you may here take notice of.

one, two, three, four, five, six, seven, eight, nine, cypher.

1 2 3 4 5 6 7 8 9 0

The Cypher serveth to make up the number of Places, but of itself signifieth nothing.

Every figure hath two values, whereof one is always certain, and hath its own signification ; but the other is uncertain, by reason of the uncertainty of the place where it may happen to stand.

A place we commonly call a space in which a figure standeth ; and look how many figures there are, so many Places there are, by which they are valued.

Every Figure in the first place simply betokeneth itself : but in the second Place, which is towards the left hand, it is ten times so much as it was in the Place before, and so increaseth its value according to its place, as you may see in the T A B L E following.

Numeration TABLE.

C. Millions.
X. Millions.
C. Thousands.
X. Thousands.
Thousands.
Hundreds.
Tens.
Units.

9 8 7. 6 5 4. 3 2 1

The first place:

9 8 7. 6 5 4. 3 2 1	987 mil. 654 thou. 321
9 8. 7 6 5. 4 2 3	98 mil. 765 thou 423
9. 8 7. 6. 5 4 3	987 mil. 876 thou 543
9 8 7. 6 5 4 3	987 thousand—654
9 8. 7 6 5 98	98 thousand—765
9. 8 7 6 9	98 thousand—876
9 8 7	987
9 8	98
9	9

Which you must read, beginning from the last Place on the left hand, and proceeding to the first at the right; in this manner, *viz.* Nine hundred eighty seven Millions, Six hundred fifty four thousand, Three hundred twenty one.

And for the better understanding of the Table, observe, that the first figure next the right hand is the place of Units, and signifies, but his own single Value; as the figure of 1 but one, 2 but two, 3 but 3 three, &c. But where two or more figures are joyned together, the figure in the second place towards the left

hand betokeneth its own single value ten times; and so in the third place signifies his own value an hundred times; in the fourth place a thousand times.

Example. 6 in the fourth place is six thousand, 6 in the third place is six hundred, 6 in the ninth place is six hundred Millions.

And thus you see the value of the figure is according to the place it standeth in.

The names of the places therefore you must be sure to get by heart.

To help you in the expressing of great numbers, you may make a Period or Prick with your Pen between every three figures, beginning at the right hand; as in this Example.

123.456.789. Here you see, is one hundred twenty three, four hundred fifty six, seven hundred eighty nine. Thus you must express all figures: But to know the value of them, you must begin at the right-hand, and reckon towards the left, according to the precedent Table, and you will find them to be one hundred twenty three millions, four hundred fifty six thousand, seven hundred eighty nine.

There are three Sorts of Numbers:

1. A Digit.

2. An Article.

3. A mixt or Compound.

All Numbers not exceeding the nine Units are called Digits; as 1, 2, 3, 4, 5, 6, 7, 8, 9.

Articles are Numbers consisting of a Digit and a and a Cypher; as 10, 20, 30, 40, 50, 60, &c.

A Compound is a Number consisting of both; as 13, 14, 15, 16, 17, &c.

C H A P. II.

A D D I T I O N.

Without the lesser Denominations.

BEfore I begin to acquaint you with the working of any of the Rules following, I shall (all along in their proper Places) first shew you the nature and meaning of the Rules, and secondly the Manner of their working.

What Addition Teacheth.

Addition teacheth you to add two or more Sums together, to make them one whole or total Sum, viz.

Example,

Received at several times these particular Sums following: viz.

At one time	341
At another time	158
More	217
More	596
More	179
I desire to know how much was received in all	1491

I. For the working of this, and all others of this kind, you must begin with the first and lowermost figure at your right-hand, saying 9, 6, 7, 8, and 1, makes 31; then set down the 1 in a Line underneath, and carry the 3 unto the next place, where 7, 9, 1, 5, 4, and 3 that I carried make 29, which

6

Addition.

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9 set down, and carry the 2 unto the next place towards your left-hand, saying, 1, 5, 2, 1, 3, and 2 that I brought, make 14, which set down. So that you see all the particulars do make 1491.

A General Rule.

For Sums of one Denomination in Addition, observe to set down all that is above Ten or Tens, and under Ten: and for every Ten carry one to the next place; until you come to the last, which must always be set down as in the former Example, and this following appeareth.

2734
3945
6542
5763
9278
1712

29974

Here I think it not amiss to advise you, to be sure for your clearer working, to set down the figures of every rank in a freight Line under one another; as you see in the foregoing Sums, Units under Units, Tens under Tens, &c.

Addition of Money with the lesser Denominations.

II. I need not here to acquaint you that four Farthings make a Penny; twelve Pence a Shilling; and twenty Shillings a Pound.

But thus much, I desire you to mind in all Additions and Subtractions, the Title of your Account; and

Chap II. Addition.

and how many of the first Denomination do make one of the second; and how many of the second do make one of the third, and how many of the third do make one of the fourth; and so in this manner, if there are more. The Observation of this will much facilitate the Work, and save both you and me a great deal of Labour; therefore I shall only give one or two Examples of each, cast up to your hands.

For the effecting of this, consider, as before, how many of the first Denomination do make one of the second, (which is here 20;) therefore for every 20 Shillings carry one Pound to the Pounds, as thus; 1, 6, 8, 7, and 1 Shilling is 23 Shillings; then come down upon the Tens, and say, 23 and 10 is 33, and 10 is 43, and 10 is 53, and 10 is 63, and 10 is 73, and 10 is 83 Shillings: now 83 Shillings being 4 Pound 3 Shillings, set down only the 3 Shillings, and carry 4 to the next, saying, 9, 1, 8, 1, 7, and 4 that I carried in my mind, is 30, set down a 0, and carry the 3 to next, saying, 1, 7, 3, 2, and 3 I carried, is 16; set down 6, and carry 1 to the next, saying, 3, 4, 1, 1, 1, 3, and 1 that I carried, is 14; which by reason there is not any other Place to carry it unto, only set it down according to this Example.

<i>l.</i>	<i>s.</i>
327	11
101	10
100	17
138	18
471	16
319	11
1460	03

As before; so again consider the Title of your Account, and how many of the one make the other; then begin with the first Figures at your right hand, 5, 7, 1, 8, and 1, which being added together make 22, and coming down upon the Tens, say 22 and 10 is 32, and 10 is 42, and 10 is 52, (and so on if there were more.) Now consider how many Shillings 52 Pence make, viz. 4 Shillings and 4 Pence; let down the 4 Pence, and carry the 4 Shillings to the Shillings, saying 4 that I carry, and 8 is 12, and 7 is 19, and 1 is 20, and 3 is 23, and 6 is 29, and 1 is 30; then come down upon the Tens, 40, 50, 60, 70, 80, and 10 is 90 Shillings, which is 4 Pounds 10 Shillings; set down the 10 Shillings and carry the 4 Pounds to the Pounds, saying 4 and 6 is 10, and 1 is 11, and 5 is 16, and 7 is 23, and 1 is 24, which 4 set down and carry the 2 unto the 9, which will make 11, and 4 is 15, and 6 is 21, and 4 is 25, and 1 is 26, and 1 is 27, which set down, and the total amounts to 274*l.* 10*s.* 4*d.* as you see in this Example.

<i>l.</i>	<i>s.</i>	<i>d.</i>
11	—	11
10	—	08
47	—	10
69	—	11
41	—	07
96	—	05
274	—	04

You may make a Prick with your Pen at every 4 in the Farthings, and at at every 12 in the Pence, and at every 20 in the Shillings: But this way is neither

Chap. II.

Addition.

neither so neat nor commendable ; for if you once prick false, you must prick it all over again, which will look like so many Blots, and make you more subject to mistake.

Therefore I recommend these two Tables following to you, to be gotten perfectly by heart, before you adventure upon Addition, as one Shilling is 12 Pence, 2 Shillings is 24 Pence, and so on.

Note that

s.	d.	s.	d.
1	12	20	1
2	24	30	2
3	36	40	3
4	48	50	4
5	60	60	5
6	72	70	6
7	84	80	7
8	96	90	8
9	108	100	9
10	120	110	10
11	132	120	11
12	144		

Note also that

s.	d.	s.	d.
1	12	20	1
2	24	30	2
3	36	40	3
4	48	50	4
5	60	60	5
6	72	70	6
7	84	80	7
8	96	90	8
9	108	100	9
10	120	110	10
11	132	120	11
12	144		

The Proof of Additions

Add all the Sums again (except the uppermost) which is here 300 £. 11 s. 6 d. 2 q. and then add the Total thereof unto the said uppermost line, and if it makes the just Sum of the first Total, it is true, otherwise not.

Example

B 5

10 The Proof of Addition. Ch. II.

Example.

<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>grs.</i>
300	11	06	2
102	15	11	1
106	17	10	0
241	18	11	1
601	11	11	1
314	10	10	2
611	11	11	1
Total	2279	19	00 0
1979	07	05	2
Proof	2279	19	00 0

Addition of Cloth-Measure.

III. Note, That 4 Nails make 1 Quarter of a Yard; 1 Yard 4 Quarters; 1 Ell Flemish, 3 Quarters of a Yard; 1 Ell English, 5 Quarters or 20 Nails.

You see the Title of your Account is Yards, Quarters, and Nails; now observe how many Nails make one Quarter; which

are 4: therefore for every *Yards. Quar. Nails.*

4 carry 1 Quarter to the	371	1	1
Quarters; and likewise for	106	3	2
every 4 Quarters, which	410	2	3
make a Yard, carry 1 Yard	716	3	1
to the Yards, and in the	151	2	3
Yards, (or last Denomina-	171	1	2
tion of any Addition) for	412	1	1
every 10 carry 1 to the	601	3	2
next place, until you come	912	1	3
unto the last Rank; which			
Total, set down as in these	3855	1	2

Examples, *Yds.*

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Addition.

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Td.	Qrs. na.	El.	Eng.	qr. na.	El.	Fl.	qr. na.	
31	1	2	47	1	2	54	1	2
27	2	3	_____	_____	_____	16	2	1
14	1	2	31	2	3	31	1	2
16	1	3	41	4	3	91	2	1
35	3	1	17	1	2	31	2	3
27	2	0	38	3	1	_____	_____	_____
_____	_____	_____	27	1	0	226	1	1
_____	_____	_____	_____	_____	_____	_____	_____	_____
153	0	3	_____	_____	_____	_____	_____	_____
_____	_____	_____	203	4	3	_____	_____	_____

Proof—203—4—3

Addition of Wine Measure.

IV. The same Order, that is set down in the second Section of this Chapter, is here to be observed; and likewise in all the Additions following.

Example.

For 2 Pint-carry 1 Quart, for 2 Quarts 1 Pottle, for 2 Pottles 1 Gallon, for 63 Gallons 1 Hoghead, for 4 Hogheads 1 Tun.

Tuns.	hogsh.	gal.	pott.	qtis.	pints.
321	3	16	1	0	1

102	1	10	1	1	0
317	1	15	0	1	1
241	2	30	1	0	1
317	1	40	1	1	1
171	3	10	0	1	1
141	2	10	1	0	1
131	1	17	1	1	0

Total. 1745—0—27—0—0—0—0

1423—1—10—0—1—1

Prova. 7745—0—27—0—0—0—0

Addition

Addition of Troy Weight.

For 24 Grains carry 1 Penny Weight,
for 20 Penny Weight, carry 1 Ounce,
for 12 Ounces carry 1 Pound.

℥	3	pw.	gr.	℥	3	pw.	gr.
371	—11—	19—	3	41	—10—	17—	10
102	—10—	10—	41	38	—11—	14—	11
413	—11—	16—	10	10	—10—	15—	15
176	—03—	15—	11	11	—11—	11—	10
912	—10—	18—	19	10	—10—	17—	16
341	—11—	13—	22				
—	—	—	—	107	—07—	16—	14
2340	—00—	18—	15				

Addition of Avoirdupoise Weight.

For 16 Ounces carry 1 Pound, for 28 Pounds carry 1 Quarter, for 56 Pounds 2 Quarters, for 84 Pounds 3 Quarters, for 112 Pounds 4 Quarters (or one Hundred Weight) for 20 Hundred 1 Tun.

Example.

Ct.	Do.	Wt.	Gr.	Pr.	Gr.	Pr.	Gr.	Pr.
95	3	27	15	91	19	3	17	15
10	1	16	14	91	19	3	17	15
11	2	10	10	91	11	2	11	14
31	1	11	12	60	14	3	10	11
71	1	11	10	30	11	2	11	13
10	3	11	13	78	10	1	13	13
227	03	1	10	08	41	11	2	11

Addition of Dry Measures.

For 16 Pints carry 1 Peck; for four
Packs carry 1 Bushel.

Bush.	Pcks.	Pint.	Bush.	Pcks.	Pint.
317	1	10	409	1	10
102	3	11	103	2	10
413	2	10	716	1	11
171	1	11	317	1	10
106	1	10	106	3	11
1112	1	14	94		

Addition

Addition of Time.

For 60 Minutes, carry one Hour; for 24 Hours, carry one Day; and for 365 Days, one Year.

Years	Days	Hours	Min.
37	—150—	11—	12
31	—110—	10—	10
14	—175—	15—	23
10	—101—	11—	11
11	—137—	12—	14
10	—101—	11—	13
115	—046—	23—	23

Addition of Long Measure.

For 12 Inches carry 1 Foot; for 3 Feet 1 Yard.

Yards	Feet	Inches	Yards	Feet	Inches.
81	—1—	10	300	—2—	11
17	—2—	11	101	—1—	10
10	—2—	07	602	—2—	11
31	—1—	10	107	—1—	10
41	—2—	11	101	—0—	08
10	—0—	10	710	—1—	11
			810	—2—	10
194	—0—	11			

C H A P. III.

SUBTRACTION,
of Money.

Subtraction teacheth to take any lesser Number out of a greater, and how to know what remains,

I. *Subtraction of one Denomination.*

First set down the greater Number from which you would subtract ; and then place the lesser Number to be subtracted, under it, as in Addition ; with a Line drawn beneath them.

Example, Received ——— 379
Laid out ——— 136

Then take the first figure towards the right hand in the Sum to be subtracted from the figure over it ; as 6 from 9 and there remains 3, which 3 set down ; then 3 from 7 and there remains 4. Lastly, 1 from 3 and there remains 2, which 2 set down.

379
136

And there remains unpaid.—243

But I shall give you one or two Examples, wherein the figures of the Sum to be subtracted, are some of them greater and some lesser than those you must subtract from ; therefore if there be only one Denomination, borrow 10, and add to the upper figure ; as in this Example.

Received

Received 4130624Paid out 104146Remains 4026478

Say 6 from 4 I cannot, but 6 from 14 and there remains 8, which set down; 1 that I borrowed and 4 makes 5, 5 from 2 I cannot, but 5 from 12 I may take, and there remains 7; which 7 set down. Then 1 that I borrowed and 1 is 2, 2 from 6 and there remains 4; now 4 from 0 I cannot, but 4 from 10 and there remains 6; then 1 that I borrowed and 6 is 7, now 7 from 3 add there remains 2. Then lastly 1 from 1 and there remains 0.
So that if you take 104146 from 130624 there remains 2026478.

II. Subtraction of several Denominations.

But if there be several Denominations, than observe, as before in Addition of Money, how many of the first make one of the second, and so on. And if the Figure of Fifties be greater than those you are to subtract from, borrow one from the next Denomination, and subtract from it; and add the Remains to the upper Figure.

Received 275 11 03
Laid out 196 12 05

Remains 078 18 10

Example

Example, Take 5 *d.* from 3 *d.* I cannot, but 5 *d.* from a Shilling or 12 *d.* and there remains 7 *d.* which added to the 3 *d.* makes 10 *d.*

Again, one Shilling that I borrowed (for you must be sure to pay what you borrow) and 12 is 13, which to take from 11 I cannot; then say 13: from 20 s. and there remain 7, and the 11 makes 18, which set down.

Again, 1 that I borrowed and 6 is 7: now 7 from 5 I cannot, but 7 from 15, and there remains 8. Then 1, that I borrowed and 9 is 10; now 10 from 7 I cannot, but 10 from 17, and there remains 7, which set down. Then 1 that I borrowed and 1 is 2: 2 from 2 and there remains 0. (nothing)

So that,	l.	s.	d.
_____	196	12	05
being taken from	275	11	03
there remains	078	18	10

And thus in any other of this nature, observe that the same that you carried in Addition, the same you must borrow in Subtraction: as 12 in the Pence, 20 in the Shillings, and 10 in the last Denomination. I need say no more, only I shall acquaint you how to know whether your Work be well done or no.

Proof of Subtraction.

Add the Remains to the Sum subtracted; and if it make the same Sum with that which you did subtract, it is true, else not. As in the last Example 78 *l.* 18 *s.* 10 *d.* and 196 *l.* 12 *s.* 5 *d.* being added; do make the same Sum, with the Sum received.

Subtraction

Subtraction of Cloth-Measure.

Yards. grs. na. Ells Flem. grs. n.

Bought—3712—1—2 Bo—4171—2—1
 Sold—1913—2—1 So—1317—2—3

Rem.—1798—3—1 Rem.—2853—3—2

Proof—3712—1—2

Ells Eng. grs. na.

Bought—4716210—2—1
 Sold—1091317—3—3

Remains 3624892—3—2

Subtraction of Avoirdupois Weight.

For the better understanding of the Rule, observe (as you did before) the Title of your Account; and where you cannot take one number out of another, take it out of the next Denomination; as you see here, 12 from 10 I cannot, but 12 Drams from 1 Ounce, there resteth 4, and the 10 makes 14; 14 from 11 I cannot, but 14 from 16 and there remains 2; 2 and 11 is 13. Now 1 that I borrowed and 14 is 15; 15 from 11 I cannot, but 15 from 28 and there remains 13; 13 and the 11 is 24. Now 1 that I borrowed, and 3 is 4; 4 from 2 I cannot, but 4 from 4 and there remains nothing, but 2 is 2; which you must set down. Now 1 that I borrowed and 8 is 9; 9 from 7 I cannot, but 9 from 17 and there remains 8. Now 1 that I borrowed and 1 is 2; 2 from 4 and there remains 2.

C. grs. lb. ozs. dr.

Bought—47—2—11—11—10
 Sold—18—3—14—13—12

Remains—28—2—24—13—

CHAP.

CHAP. IV. MULTIPLICATION.

The Multiplication-Table.

2 times	$\left\{ \begin{array}{l} 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{array} \right\}$	is	$\left\{ \begin{array}{l} 4 \\ 6 \\ 8 \\ 10 \\ 12 \\ 14 \\ 16 \\ 18 \end{array} \right\}$	5 times	$\left\{ \begin{array}{l} 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{array} \right\}$	is	$\left\{ \begin{array}{l} 25 \\ 30 \\ 35 \\ 40 \\ 45 \end{array} \right\}$
3 times	$\left\{ \begin{array}{l} 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{array} \right\}$	is	$\left\{ \begin{array}{l} 9 \\ 12 \\ 15 \\ 18 \\ 21 \\ 24 \\ 27 \end{array} \right\}$	6 times	$\left\{ \begin{array}{l} 6 \\ 7 \\ 8 \\ 9 \end{array} \right\}$	is	$\left\{ \begin{array}{l} 36 \\ 42 \\ 48 \\ 54 \end{array} \right\}$
4 times	$\left\{ \begin{array}{l} 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{array} \right\}$	is	$\left\{ \begin{array}{l} 16 \\ 20 \\ 24 \\ 28 \\ 32 \\ 36 \end{array} \right\}$	7 times	$\left\{ \begin{array}{l} 7 \\ 8 \\ 9 \end{array} \right\}$	is	$\left\{ \begin{array}{l} 49 \\ 56 \\ 63 \\ 64 \end{array} \right\}$
				8 times	$\left\{ \begin{array}{l} 8 \\ 9 \end{array} \right\}$	is	$\left\{ \begin{array}{l} 72 \end{array} \right\}$
				9 times	$\left\{ \begin{array}{l} 9 \end{array} \right\}$	is	$\left\{ \begin{array}{l} 81 \end{array} \right\}$
				10 times		is	$\left\{ \begin{array}{l} 100 \end{array} \right\}$

L. For

1. **F**OR the clearer understanding of this Table, observe the Figures in the Margent. 2, 3, 4, &c. and the Word *(times)* adjoining to them; say 2 times 2 is 4, 2 times 3 is 6, 2 times 4 is 8, 2 times 5 is 10, &c. After you know well how to read it within Book, you must of necessity get it very perfectly by heart, before you can make any farther Progress in this Art.

The Use of Multiplication.

Multiplication serveth instead of many Additions, and teacheth of two Numbers given, to increase the greater as often as there are Units in the lesser.

There are three Things strictly to be observed, viz.
 1. The *Multiplicand*, or Sum to be multiplied.
 2. The *Multiplier*, or Sum by which you multiply.
 3. The *Product*, or Sum produced.

Ask how much is 7 times 52, or in 52 Weeks how many Days there are?

If you should add 7, 52 times, it would be a tedious Work; but Multiplication will do that at once, which Addition should do at many times; in Multiplication therefore first set down the greatest Number and the lesser under it, beginning at the right-hand, and Multiply every Figure of the Multiplicand, by each Figure of the Multiplier: then (do as in Addition) set down all that is under Ten, or above Ten, or Tens, and for every Ten (or Article) carry one to the next place, and in the last place set down the Tens:

Example.

Example.

52 Multiplicand.

7 Multiplier.

364 Product.

Begin with the Multiplier, saying 7 times 2 is 14 set down the 4 under the 7, and carry one to the next place saying 7 times 5 is 35, and 1, that I carried is 36, which set down as you see in the Example: so that 7 times 52 is 364.

In 3712 Shillings, how many Farthings: or how much is 48 times 3712?

Be careful in setting the Figures of the Multiplier under the Multiplicand, for Units must be under Units, Tens under Tens, Hundreds under Hundreds: and having rightly placed.

your Figures, then proceed according to your former Example, saying 8 times 2 is 16, set down 6, and carry 1 to the next Place, say then 8 times 1 is 8, and 1 that

I carried is 9, set down 9, and carry nothing. saying, 8 times 7 is 56, set down 6 and carry 5 to the next Place, saying, 8 times 3 is 24, and 5 is 29, which set down. And having done with the first

Figure of the Multiplier, cancel it with a dash of the Pen, and proceed to the next, say-

ing 4 times 2 is 8, which 8 set down

directly under the Multiplier, then

say, 4 times 1 is 4, which set down,

then 4 times 7 is 28, which 8 set

down, and carry 2; then 4 times 3

is 12, and 2 that I carried is 14,

which being set down, you shall find

48 times 3712 to be 178176.

$$\begin{array}{r}
 3712 \\
 \times 48 \\
 \hline
 29696 \\
 14848 \\
 \hline
 178176
 \end{array}$$

Observation

Observations.

1. *Note*, There must be found, as many particular *Products*, as there are significant *Figures*, or *Places*, in the given *Multiplicier*; excepting the *Work* is otherwise Contracted, or Compendiously Performed.

2. *Note*, In Multiplying by Numbers, consisting of Two or more *Digits*, or *Places*; Care must be used, in the Right Placing the *Product* of each *Multiplicier*, under another; in such Manner, that the *Units* of the *Second* particular *Product*, must stand under the *Tens* of the *First*; and consequently under the Figure you *Multiphied* by; and the rest Orderly, and successively, from the Right-Hand to the Left, in order to find (by *Addition*) the desired *Number*; or *Summ* of the Particular *Products* sought.

How to Multiply by 10, 100, 1000, 10000, &c.

Look how many Cyphers you have in your *Multiplier*, add them to your *Multiplicand*; and the *Total* thereof shall be the *Product*.

Example.

Multiply	$\begin{array}{r} 63 \\ 36 \\ 85 \\ 92 \\ 73 \end{array}$	by	$\begin{array}{r} 10 \\ 100 \\ 1000 \\ 10000 \\ 100000 \end{array}$	facit	$\begin{array}{r} 630 \\ 3600 \\ 85000 \\ 920000 \\ 7300000 \end{array}$
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How

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How to Multiply by 20, 40, 300, 5000. &c.

As many Cyphers as there are in the Multiplier ; set them down towards the right hand ; and multiply the rest, as before is taught.

Example.

$$\begin{array}{r} 37 \\ 20 \\ \hline 740 \\ \hline \end{array} \qquad \begin{array}{r} 232 \\ 300 \\ \hline 69600 \\ \hline \end{array}$$

How to prove Multiplication.

First cast away the Nines of the Multiplicand (in your former Example) 3712 ; saying, 3 and 7 is 10, cast away 9, and there remains 1 ; then 1 and 1 is 2, and 2 is 4 ; which set on the right side of a Cross, thus :

$\begin{array}{c} + \\ 4 \end{array}$ Then cast away the Nines of the Multiplier ; saying, 4 and 8 is 12, cast away the 9, and there remains 3 ; which place on the left Side thus :

$$\begin{array}{c} 3 \\ + \\ 4 \end{array}$$

Then multiply the one by the other, saying, 3 times 4 is 12 ; cast away 9 and there remains 3 ; which place at the Top of the Cross thus :

$$3$$

$$\begin{array}{c} 3 \\ + \\ 4 \end{array}$$

Lastly, cast away the Nines of the Product ; saying, 1 and 7 is 8, and 8 is 16, cast away 9 and there remains 7 ; then 7 and 1 is 8, and 7 is 15, cast away 9 and there remains 6 ; then 6 and 6 is 12, cast away 9 and there remains 3 ; which place at the Bottom of the Cross ; and if the top Figure and the bottom be alike, your Work may be true.

This

This is the common way to prove Multiplication; But the most certain Proof is by Division, as hereafter I will shew you.

II. Yet for the more perfect understanding of Multiplication; I have here laid it down in the nature of the *Golden Rule*; which tho' it be not according to the usual Method of Teaching; yet the Experience I have had thereof, sheweth me, that it will inform any one more thoroughly in the Nature of this Rule, than any Directions I have yet read; for Tryal heretof, take sundry Examples, wrought only by multiplying second and third Numbers together, as these following.

Example.

If 1 Yard cost 17*d.* what cost 40 Yards?

$$\begin{array}{r} 40 \\ \hline 680 \text{ d.} \end{array} \qquad \begin{array}{r} 17 \\ \hline 280 \\ 40 \\ \hline \text{facit } 680 \text{ d.} \end{array}$$

Compendium.

WHEN it happens that One, or Both the Factors, or Numbers given to be Multiplied, terminates with a Cypher, or Cyphers, the Work may be much Contracted by multiplying only by the significant Figures, as above, and placing at the Right-hand of their Product, the Number of Cyphers, laid in the End of each Factor; for the complete Product, or Answer sought.

Multiplication.

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If one Pound cost 19 *d.* what cost 112 Pound?

$$\begin{array}{r} 19 \\ \hline 1008 \\ 112 \end{array}$$

facit 2128

If 1 Shilling make 12 *d.* what will 20 *s.*?

20

facit 240 *d.*

If 1 Shilling make 48 *q.* what will 20 *s.*?

20

facit 960 Farthings.

If 1 Crown be 60 *d.* what 500 Crowns?
60

facit 30000 *d.*

If 1 Yard be 16 Nails, what 576 Yards?
16

$$\begin{array}{r} 3456 \\ 576 \end{array}$$

facit 9216 Nails.

If 1 Ell Eng. make 20 *Na.* what 246 Ells?

20

facit 4920 *Na.*

If 1 Gall. make 8 Pints, what 63 Gallons?
8

facit 504 Pints.

If 1 Hogsh. makes 63 Gall. what 4 Hogsh. ?
4

facit 252 Gallons.

If 1 Tun makes 252 Gallons, what 20 Tun ?
20

facit 5040 Gallons ?

If 1 Inch be 3 Barly-Corns, what 12 Inches ?
Answer 36 Barly-corns.

facit 36

If 1 Foot be 12 Inches, what 379 Feet ?
12

facit 4548 Inches

If 1 Yard be 3 Feet; what 478 Yards ?
3

facit 1434

If 1 Furlong be 40 Poles, what 846 Furlongs ?
40

facit 33840

If 1 Mile be 8 Furlongs, what 100 Miles ?
8

facit 800 Furlongs

If 1 Pound be 12 Ounces, what 176 Pounds ?
Answer 2112 Ounces.

facit 2112.

Multiplication.

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If 1 Ounce be 20 Penny-Weight, what 12
Ounces ?

20

If 1 Penny weight be 24 Grains, what 20
Penny-weight ?

20

If 1 Pound be 16 Ounces, what 11 Pounds ?

2

672
112

If 1 Quarter be 28 Pounds, what 4 Quarters ?

4

If 1 C. be 112 Pounds, what 20 C ?

20

If 1 Tun be 20 C, what 846 Tuns ?

20

If 1 C. gross alloweth 15 Pound Tare,
what will 72 C. gross ?

15

360
72

facit 1080 lb. Tare.

C 2

If 1 C. gros give 13 Pound Tare, what will 96 C. gros give?

$$\begin{array}{r} 13 \\ \hline 288 \\ 96 \end{array}$$

facit 1248 lb Tare.

If 1 Dollar be 56 d. what 500 Dollars?

$$\begin{array}{r} 56 \\ \hline 3000 \\ 2500 \end{array}$$

facit 28000 pence.

Or more concisely, thus; 500 Dollars.
56 d.

facit 28000 Pence.

If 1 French Crown be 6 s. what 866?

facit 5196.

If 1 l. cost 37 d. what cost 475 l.?

$$\begin{array}{r} 3325 \\ 1425 \end{array}$$

facit 17575 d.

Note, There might have been added several other *Compendious Methods*, in *Multiplication*; which are here Omitted; seeing my Design herein, is not to alter the *Author's Method*, but only to *Correct*, *Illustrate*, and *Improve* it.

C H A P. V.

CHAP. V.

DIVISION.

Division, is that, by which we know how many times a lesser Sum is contained in a greater.

The Parts of Division

In Division $\left\{ \begin{array}{l} 1. \text{ The Dividend.} \\ 2. \text{ The Divisor.} \\ 3. \text{ The Quotient.} \\ 4. \text{ The Remain.} \end{array} \right.$ observe,

1. The *Dividend* is the Sum to be divided.
2. The *Divisor* is the Sum by which we divide.
3. The *Quotient* is the Sum produced, and contains so many times the *Divisor*, as it self is in value.

4. The *Remain*, is always less than the *Divisor*.
First, Set down the Dividend, and right under it, towards the left hand, the Divisor.

Example.

Being to divide 4648 half-pence, by the number of halfpence in a penny.

I first set down the Dividend, and then the Divisor under the first figure, thus

4648 (
 2

But if the figure or figures just over the Divisor be lesser than the figures under it, the Divisor must be removed one degree or place more towards the right-hand.

C 3

Example.

Example.

I would divide 4648 farthings by 48, the number of farthings in a shilling; then I must set my Divisor thus:

$$\begin{array}{r} 4648 \\ 48 \end{array}$$

And at the end of the two numbers make a crooked Line wherein to include the Quotient thus (Yet before you begin your work, consider three things, *viz.*

1. *Seek how often the Divisor, is contained in the Dividend.*

2. *Multiply the Quotient and Divisor together.*

3. *Subtract the Product from the Dividend.*

To propound then the former Example.

In 4648 halfpence, if I would know how many pence.

$$\begin{array}{r} 4648 \\ 2 \end{array}$$

I must seek how many times 2 is contained in 4, which is twice; then I set 2 in the Quotient, and multiply it by the Divisor, saying 2 times 2 is 4; now 4 from 4, and there remains nothing; which 2 having performed its first office, I cancel with a dash of the pen, and remove it one place nearer the right-hand thus:

$$\begin{array}{r} 4648 \\ 22 \end{array}$$

Then I say again, how many times 2 in 6; which is 3 times; I set down 3 in the Quotient, and multiply by 2, saying, 3 times 2 is 6; now 6 from 6, and there remains 0.

Again,

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Again I remove the Divisor, thus:

$$\begin{array}{r} 4848(23 \\ 222 \end{array}$$

Thus, and try how many times 2 in 4, which is two times, therefore I set 2 in the *Quotient*, and Multiply it by 2 (the Divisor) saying 2 times 2 is 4, now 4 from 4, and there remains 0.

$$\begin{array}{r} 4848(232 \\ 222 \end{array}$$

Again, I remove the Divisor, and try again how often 2 is contained in 8, which is 4 times, I set 4 in the *Quotient*, and multiply it by 2, saying, 4 times 2 is 8: now 8 from 8, and there remains 0.

$$\begin{array}{r} 4848(2324 \\ 2222 \end{array}$$

Another Example with one Figure.

Suppose there is 398 pounds to be equally divided between 6 men, the demand is what each man must have?

First, I set down the Dividend 398, and 6 (the Divisor) under 9 thus, because I cannot take 6 out of 3.

$$\begin{array}{r} 398(6 \\ 6 \end{array}$$

Then I try how many times 6 I can have in 39, which is 6 times, I place 6 in the *Quotient*, beyond the crooked line; saying, 6 times 6 is 36; now 36 from 39, and there remains 3, which I set down over the 9, and cancel the 39 and 6, my Divisor, thus.

$$\begin{array}{r} 398(6 \\ 6 \\ C4 \end{array}$$

Again

Again, I remove my Divisor to the next place under 8, and seek how many times 6 I can have in 38; which is also 6 times; I set 6 in the Quotient, saying, 6 times 6 is 36, 36 from 38, and there remains 2, which 2 I set over the 8, and cancel my 6 thus;

$$\begin{array}{r} 6 \text{ } ^{(2)} \\ 3 \overline{) 38} \text{ } (66 \\ \underline{18} \\ 20 \\ \underline{12} \\ 80 \\ \underline{72} \\ 80 \\ \underline{72} \\ 80 \\ \underline{72} \\ 80 \end{array}$$

So that every man must have 66*l.* and 2*l.* over, which I may turn into pence, and divide also by 6, and the Quotient will be 80 pence, which is in all 66 pounds, 6 shillings and 8 pence, a-piece.

This Order I observe to divide by one Figure, but if the Divisor do consist of more figures than one, I must take the first figure of the Divisor no other out of the Dividend than I can also take all the rest of the Divisors out of the Dividend that stands above them, as in the Examples following may appear.

But before you proceed to divide by 2 Figures or more, be careful to understand well, how to divide by one.

How to prove Multiplication.

In Multiplication, I told you, that the most certain Proof for that Rule, was by Division; I shall therefore take the Product of one of the Multiplications foregoing, and divide it by the Multiplier thereof, to try the former work; as for example, I would divide 178176 by 48, which was one of the former Products in Multiplication, which Numbers place as in the Example following.

$$\begin{array}{r} 178176 \text{ } (\\ 48 \end{array}$$

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First I seek how many times 4 is contained in 17, which I find 4 times ; now 4 times 4 is 16 ; 16 from 17 and there remains 1, which make the 8 to be but 18, now 4 times 8 is 32, 32 from 18 I cannot, therefore 4 times is too much.

2. I seek whether 3 times will do it ; saying, 3 times 4 is 12 ; now 12 from 16, and there remains 4, which makes the 8 to be 58 ; then I say 3 times 8 is 24 ; now 4 from 8, and there remains 4, then (2 that I carried) from 5, and there remains 3.

$$\begin{array}{r} 3 \\ 34 \\ \times 78176 \quad (3 \\ \hline 48 \end{array}$$

3. I remove the Divisor one place nearer the right hand ; saying, how many times 4 in 34, which is 7 times (because 9 or 8 times are too many ; then 7 times 4 is 28 ; now 28 from 34, and there remains 6 : then 7 times 8 is 56 ; 6 from 1 I cannot, but 6 from 11, and there remains 5 ; then 5 I carried, and I borrowed, is 6, now 6 from 6, and there remains nothing.

$$\begin{array}{r} 36 \\ 345 \\ \times 78176 \quad (37 \\ \hline 488 \end{array}$$

C 5.

Again;

Again, I remove the Divisor ; saying how many times 4 in 5, which is once ; then I say once 4 is 4. Now 4 from 5 and there remains 1. Then once 8 is 8 ; now 8 from 17, and there remains 9, and 1 that I borrowed from 1, there remains nothing.

$$\begin{array}{r} 36x \\ 8889 \\ x78x78 \quad (371 \\ \hline 4888 \\ 44 \end{array}$$

Again, I remove the Divisor, and seek how many times 4 is in 9, which is twice ; saying, 2 times 4 is 8, now 8 from nine, and there remains 1. Then 2 times 8 is 16 ; now 16 from 16, and there remains nothing. So that I find the Quotient to be 3712, the same as the Multiplicand was in the Multiplication, which is a most certain Proof of that Rule.

How to prove Division.

$$\begin{array}{r} 36x1 \\ 8889 \quad 0 \\ x78x78 \quad (3712 \\ \hline 48888 \quad 48 \\ 444 \quad \hline 29696 \\ 14848 \\ \hline \text{Proof } 178176 \end{array}$$

And as Division is a sure Proof of Multiplication, so Multiplication is the surest Proof of Division ; which is performed, by multiplying the Quotient with the Divisor : and if the Product thereof be the

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the same with the Dividend, your Division is well wrought, otherwise, be sure some Error is committed in your work.

Also if any Figures remain after your Division is ended, they must be added into the Product of your Multiplication, according to their several places, and then (if true) the Total will be likewise the same with the Dividend; as for Example, doth appear in the last Sum of this Rule.

A more easie way of Division, and with fewer Figures.

There are 4648 Shillings, to be equally divided between 34 Men: I demand what is each Man's portion.

I will not stand to shew you more of this common Way of Division, which is indeed very tedious and burthenome to the memory, and hath caused (to my knowledge) many to despair of attaining it, and so proceeding further in this Art; but proceed by the Method following, which will enable one to go on with far more ease and delight than commonly is seen.

The Question being stated, is to be set thus,

4684 (

34

Wherein consider how often 34 is contained in 46, which is once (or rather see first how often 3 is contained in 4, which likewise is once) then set

C 4

1 in

1 in the Quotient, saying, once 4 is 4; now 4 from 6, and there remains 2; which 2 set directly over its Dividend.

$$\begin{array}{r} 12 \\ 4\cancel{6}34 \text{ (1} \\ 34 \end{array}$$

Then go backward to the next, saying, once 3 is 3, from 4 and there remains 1; which also set over the 4, and cancel it, and 3 the Divisor, with a dash of the Pen, as you see in the Example.

Then remove the Divisors one degree further towards the right-hand thus:

$$\begin{array}{r} 12 \\ 4\cancel{6}84 \text{ (1} \\ 344 \\ 3 \end{array}$$

Then considering how often 3 is contained in 12, which is 4 times; but 4 times the next Divisor cannot be taken out of 8, and you must never take one of the Divisors oftner than you

can take all the rest; seeing then 4 times is too much, try (in your mind)

$$\begin{array}{r} 2 \\ 826 \end{array}$$

whether each Divisor can be taken

$$4\cancel{6}84, \text{ (13}$$

3 times, if so, then place 3 in the Quotient, saying, 3 times 4 is

$$344$$

12, 12 from 8 I cannot, but 12

from 18 and there remains 6; then 3 times 3 is 9, and 1 that I carried is 10, 10 from 12 and there remains 2.

A gain,

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Again, remove your Divisor towards your right-hand : thus,

$$\begin{array}{r} 2 \\ \times 26 \\ 4684 \quad 13 \\ 3444 \\ 33 \end{array}$$

Then consider how often three is contained in 26, which is 8 times, and 8 times 3 is 24 ; now 24 from 26, and there remains 2 ; which 2 will make the next figure to be but 24 ; then 8 times 4 is 32, 32 out of 24 cannot be, and therefore say 8 times is too much, which seeing so, try (in your mind) whether 7 will do it, saying 7 times 4 is 28 ; 28 from 4 I cannot, but 28 from 34, and there remains 6. Then 7 times 3 is 21 and three that I carried is 24 ; 24 from 26, and there remains 2. Cancel out the Dividend and Divisor, and set the Remains over head ; and your work is done.

$$\begin{array}{r} 2 \quad (2 \\ \times 26 \quad (6 \\ 4684 \quad (137 \\ 3444 \\ 33 \end{array}$$

The Quotient sheweth that 34 men must have 137 shillings a piece, and 26 shillings over and above to be divided amongst them.

Which Remainder, and all others of any Division, I shall leave you what they are when you practice Fractions, as the place more convenient and proper.

4 Example.

4 Example.

There is a Ship taken by 346 Sea-men which is valued at 87654 l. to be equally divided amongst them, I demand what each man must have ?

$$\begin{array}{r} 87654 \text{ l} \\ 346 \end{array}$$

Consider how many times 346 is contained in 876, which is two times; or rather how often 3 is contained in 8, which is likewise 2 times, set 2 in the Quotient, and say, 2 times 6 is 12, 12 from 6 I cannot, but 12 from 16 and there remains 4.

Then 2 times 4 is 8, and 1 that I borrowed is 9; 9 from 7 I cannot, but 9 from 17 and there remains 8. Then 2 times 3 is 6, and 1 is 7; 7 from 8 and there remains 1. Then having done with the Divisors, remove them to the next place towards the right hand, thus;

$$\begin{array}{r} 184 \\ 87654 \end{array} (2$$

Then say, how many times 3 in 18, 6 times; but that being too much, (because all the rest cannot be taken so often) therefore say, 5 times 6 is 30, 30 from 5 I cannot, but 30 from 35 and there remains 5.

$$\begin{array}{r} 184 \\ 87654 \\ 3466 \\ 34 \end{array} (2$$

Then 5 times 4 is 20, and 3 that I borrowed, is 23; 23 from 4 I cannot, but 23 from 24, and there remains 1.

$$\begin{array}{r} 11 \\ 1845 \\ 87654 \\ 3466 \\ 34 \end{array} (25$$

Then

72
ph
32
73
lay
32

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Then 5 times 3 is 15, and 2 that I borrowed is 17; 17 from 18, and there remains, 1.

Again, remove the Divisors (pondering in your mind) how many times 3 can I have in 11, 3 times; by which I perceive 3 will do it, therefore place it in the Quotient, saying, 3 times, 6 is 18; 18 from 41 cannot, but 18 from 24, and there remains 6: then 3 times, 4 is 12, and 2 that I carried is 14; from 51 cannot, but 14 from 15, and there remains 1: Then 3 times 3 is 9, and 1 that I carried is 10; 10 from 11, and there remains 1.

$$\begin{array}{r} \overset{(1)}{3} \overline{) 1848} \\ \underline{3} \\ 15 \\ \underline{15} \\ 0 \\ \underline{0} \\ 0 \\ \underline{0} \\ 0 \end{array}$$

5 Example.

There is a city taken in the Wars by 9034 Soldiers that is worth 7306242 l. I demand what each Soldier may have?

$$\begin{array}{r} 7306242 \\ 9034 \end{array}$$

Here you see that 9034 cannot be contained in 7306, therefore remove your Divisor to the next place toward the right hand thus:

$$\begin{array}{r} 7306242 \\ 9034 \end{array}$$

1. Consider how many times 9, can be had in 73, which is 8 times, place 8 in the Quotient; saying 8 times 4 is 32, 32 out of 21 cannot, but 32 out of 32, and remains 0.

Then

Then 8 times 3 is 24, and 3 that I borrowed is 27, 27 from 6 I cannot, but 27 from 36, and there remains 9.

Then 8 times 0 is 0, and 3 that I carried is 3 ; 3 from 10, and there remains 7.

$$\begin{array}{r} 790 \\ 73 \overline{) 56242} \quad (8 \\ 5834 \end{array}$$

Then 8 times 9 is 72, and 1 that I borrowed is 73 ; 73 from 73, and there remains 0.

Again remove your Divisor.

Here you also see, that 9034 the Divisor, cannot be taken out of the Dividend ; therefore cancel it, and remove it to the next place, setting a Cypher in the Quotient.

$$\begin{array}{r} 790 \\ 73 \overline{) 56242} \quad (80 \\ 58344 \\ 903 \end{array}$$

Then try again how often the Divisor is contained in the Dividend, which is 8 times.

Then say, 8 times 4 is 32 ; 32 out of 2 I cannot, but 32 out of 32, and there remains nothing.

Then 8 times 3 is 24, and 3 that I borrowed is 27 ; 27 from 4 I cannot, but 27 from 34, and there remains 7.

$$\begin{array}{r} (6 \quad (7 \\ 790 \quad (7 \quad (0 \\ 73 \overline{) 56242} \quad (808 \\ 583444 \\ 9033 \\ 80 \end{array}$$

Then 1 time 0 is 0, but 3 that I borrowed is 3 ;
3 from 0 I cannot, but 3 from 10, and there re-
mains 7.

Then 8 times 9 is 72, and 1 that I borrowed is
73 ; 73 from 79, and the remains 6. So that e-
very Souldier must have for his share 808 pounds.

6 Example.

*What is the Quotient of 56037478, divided by
2306803 ?*

Consider how often the Divisor is contained in
the Dividend, which is here twice.

$$\begin{array}{r} 990141 \\ 2306803 \overline{) 56037478} \quad (2 \\ 4613606 \\ \hline 2306803 \end{array}$$

Then say, 2 times 3 is 6 : 6 from 7, and there
remains 1.

Then 2 times 0 is 0 ; 0 from 4, and there re-
mains 4.

Then 2 times 8 is 16 ; 16 from 7 I cannot,
but 16 from 17, and there remains 1

Then 2 times 6 is 12, and 1 that I borrowed is
13 ; 13 from 3 I cannot, but 13 from 13, and
there remains 0.

Then 2 times 0 is 0, but 1 that I borrowed is 1 ;
1 from 0, I cannot, but 1 from 10, and there re-
mains 9.

Then 2 times 3 is 6, and one that I borrowed is
7 ; 7 from 6 I cannot ; but 7 from 16, and there
remains 9.

Then 2 times 2 is 4, and one that I borrowed is
5 ; 5 from 5, and there remains nothing.
Remove the Divisor.

Again,

Again, consider how many times the Divisor is contained in the Dividend, which is 4 times.

$$\begin{array}{r}
 67420 \\
 88888 \times 6 \\
 56837478 \quad (24 \\
 238888833 \\
 23888888
 \end{array}$$

Then say 4 times 3 is 12 ; 12 from 8 I cannot, but 12 from 18, and there remains 6.

Then 4 times 0 is 0, but 1 that I borrowed is 1 ; 1 from 1, and there remains 0.

Then 4 times 8 is 32 ; 32 from 4 I cannot, but 32 from 34, and there remains 2.

Then 4 times 6 is 24, and 3 that I borrowed is 27, 27 from 1 I cannot, but 27 from 31 and there remains 4.

Then 4 times 0 is 0, but 3 that I borrowed is 3 ; 3 from 0, I cannot, but 3 from 10, and there remains 7.

Then 4 times 3 is 12, and 1 that I borrowed, is 13 ; 13 from 9 I cannot, but 13 from 19, and there remains 6.

Then 4 times 2 is 8, and 1 that I borrowed is 9 ; 9 from 9 and there remains 0, so that the Quotient is 24 ; or the Divisor is contained in the Dividend 24 times.

Having laid down the latter part of the former Rule, in the nature of the Rule of Three, and apprehending it very necessary for young Learners, I shall therefore observe the same here in Division, which is performed by dividing the Second Number by the First, and the Quotient is the Answer to the Question.

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If 63 Gallons make 504 Pints, what 1 Gallon? Answ. 8 Pints.

$$\begin{array}{r} 804 \text{ (8 pints.} \\ 63 \text{ -} \end{array}$$

If 4 Hogheads make 252 Gallons, what 1 Hoghead? Answ. 63 Galls.

$$\begin{array}{r} 252 \text{ (6 3 gall.} \\ 4 \text{ -} \end{array}$$

If 20 Tuns make 5040 Gallons, what 1 Tun? Answ. 252 Gallons.

$$\begin{array}{r} 5040 \text{ (252 Gallons} \\ 20 \text{ -} \end{array}$$

If 72. C. gross, allow 1080 pound for Tare, what must 1 C. allow? Answ. 15 lb.

$$\begin{array}{r} 36 \\ 720 \text{ (15 pounds facit.} \\ 72 \text{ -} \end{array}$$

If 152 C. cost 7600 pounds, what 1 C?

$$\begin{array}{r} 7600 \text{ (5 pounds facit.} \\ 152 \text{ -} \end{array}$$

If 500 Dollars be 28000 d. what 1 Dollar?

$$\begin{array}{r} 28000 \text{ (56 pence facit.} \\ 500 \text{ -} \end{array}$$

As in Multiplication, when the Multiplier is 10, 100, 1000, &c. you add to the Multiplicand on the right hand so many Cyphers as are in the Multiplier, to make the Product; so in Division, when the Divisor is 10, 100, 1000, &c. you must cut off so many Figures from the Dividend, to the right hand, (with a perpendicular Line) as there are Cyphers in the Divisor; and the Figures to the left hand are the Quotient: Divide 375900 by 10, or 100, &c.

$$\begin{array}{r} \text{Quot. } 37590 \text{ (0. Quot. } 3759 \text{ (00} \end{array}$$



CHAP. VI.

Modern Division ; *Compendiously* *Per-*
form'd three Manner of Ways.

SECT. I. *Division* Illustrated, and
Render'd Easy and Concise, by the
French Method of *Cancelling*, for-
merly Used

AS this kind of *Division*, was Recommended
by the *ATHOR*, and in his Time,
was much Used : So I have hitherto preserv'd his
Property ; by pursuing his Method, in each Step of
the Work; in order to the Satisfaction of all such
Persons as Admire this Way of *Cancelling* : for-
merly practis'd by the *French* ; but now grow'n,
Obsolete. Yet to shew, how far this kind of *Di-*
vision, may be Improv'd, and Render'd *Modern* and
Useful, shall be Illustrated by

Example 7.

Q. In 165150720 *Grains*, Troy ; How many
Pounds ? Allowing each Pound to contain 5760
Grains ? Answ. 28672 lb.

See

See the WORK.

(^o)
~~4x~~ (^o) Remains •
~~38xx~~ (^o)
~~488748~~ (^o)

Divisor 5760) 165150720 (28672, its or Quotient.

115286220
 460535
 3401
 41

Total of the } 165150720 { Equal to Di-
 Multiplies. } vidend or Proof.

N. B. The Reader may here Observe, that the figures of this kind of Division, are so Methodically placed, and Orderly disposed; that the Remainders and Multiplies in the WORK, separate themselves; the former standing Cancelled above the Dividend; And the latter Underneath; without cancelling; yet in such Order, that their Sum Reverts the Dividend, or is equal to the Number given to be Divided; which, is, (Concise) an Undeniable Proof of the Work. The like will appear, in all other Examples of Division.

Explication.

FIRST, It may be Observed, the Work of the last Example renders this French way of Division, by Cancelling, so Obvious and Concise,

as even to Exhibit the Proof by Addition only ; in order to which, the Dividend (*viz.* 165150720) being plac'd between Parallel-Lines ; And the Divisor and Quotient, (as Usual) on the Left and Right-hand thereof ; then,

Secondly, When it happens, that the Divisor terminates with a Cypher or Cyphers ; the Work may be Abridged before Division is begun ; by cutting off, (by a Stroke or Line) so many Figures or Places from the Right-hand of your *Dividend*, as there are Cyphers, at the end of the *Divisor* ; then the Remaining Part of the *Dividend* ; on the Left-hand of the said Stroke or Line, must be Divided according to the following *Directions* ; by the figures of the Divisor ; after its terminating Cyphers are Omitted, or cut off : Observing that the figures so cut off from the Right-hand of the *Dividend* ; must be Annexed to the last *Remainder* in order to Compleat it ? which is usually placed (in smaller figures) above the *Divisor* ; with a Line between them, at the End of the *Quotient*.

Thirdly, Having thus Orderly dispos'd, and abridg'd the given Numbers for Operation ; begin (as usual) at the Left-hand ; and Ask how oft the *Divisor* is contained in the 1st part of the *Dividend* or *Dividual* ; (*viz.* 576 in 1651) the Answer (upon Tyal) is found to be 2 ; which place in the *Quotient*, and Multiply the Divisor thereby, (*viz.* 576 by 2) ; make 1152, for the 1st *Product* ; which being placed underneath the *Dividual*, and subtracted therefrom ; the *Remainder*, is 499, to be orderly placed above the last *Dividual* ; to which Annex the next figure of the *Dividend*, (*viz.* 5) make 4995, for a New *Dividual* : Then how oft 576 in 4995 ; Or more briefly, how oft 5 in 49 ? *Ans.* 8 times ; which being plac'd in the *Quotient* ; and the

the *Divisor* (*viz.* 576) Multiplied thereby, make 4608 for the 2d *Product*; whose Unit's Place (*viz.* 8) must be placed under the Unit's Place of the last *Dividual* (*viz.* 5) And the Rest in order from the Right-hand to the Left; then *Subtraction* being made (*viz.* 4608 from 4995) the *Remainder* is, 387; which must be so placed above the last *Remainder*, that 7 must stand above the first Place of the last *Dividual*; (*viz.* 5) Observing always, when *Subtraction* is made, to Cancel the last *Remainder* (*viz.* 499) ; then 387, the new *Remainder*, will stand before 0, the next Place of the *Dividend*; And will make 3870 for a New *Dividual*: Then how often 576 in 3870; Or 5 in 38? *Ans.* 6 times; which I place in the *Quotient*; and Multiply (576) the *Divisor* thereby; make 3456 for the 3d *Product*; which being Deducted from 3870, the last *Dividual*; the New *Remainder*, (after the last is Cancelled) is 414; to which Point Annex 7 the next place in the *Dividend*; make 4147, for a New *Dividual*: Then how often 576 in 4147? Or 5 in 41? *Ans.* 7 times; which being placed in the *Quotient*, and 576, the *Divisor*, Multiplied thereby; make 4032 for the 4th *Product*; which Subtracted from 4147, the last *Dividual*, leaves 115, for a New *Remainder*, (after the last is Cancelled) to be Annexed to the last place or Significant figure, in the *Dividend*, (*viz.* 2) make 1152; for a New *Dividual*: Then how often 576 in 1152; or 5 in 11? *Ans.* 2 times; therefore, placing 2 in the *Quotient*, and Multiplying the *Divisor* thereby, (*viz.* 576) the 5th or last *Product* is 1152; which being Subtracted from 1152; the last *Dividual*; the *Remainder* is 0, And the Compleat *Quotient* sought, is 28672; as in the Example, which see.

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Note, That in the Work of each *Example* it is needful for the *LEARNER* to have it commodiously placed under his Eye, so as to view, Compare, and Apply it. with each Step of the *Explication* ; by means whereof, he will soon be Enabled to perform readily, not only that *Example*, but also any other of the like Nature, tho' differing in Method.

SECT. II.

The Italian Way of Division, According to the easiest Method.

HAVING shewn accurately the Performance of *Division*, according to the *French Method* ; what Remains, is to shew, how the same may be readily Effected, the *Italian Way*, according to the Custom of *Schools* ; who esteem it more Agreeable to the Capacity of the *LEARNER* ; especially when it is thus *Illustrated* by the following *Example*, and its *Explication*.

Example 8.

Q. How many Years are Equal to 11518282005 Days ; when 1 Common Year contains 365 Days ?
Ans. 31556937 Years.

See the Work.

<i>Divisor.</i>	<i>Dividend.</i>	<i>Quotient.</i>
365.)	11518282005.	(31556937.
	+ 1095	

$$\begin{array}{r} 568 \\ + 365 \\ \hline \end{array}$$

$$\begin{array}{r} 2032 \\ + 1825 \\ \hline \end{array}$$

$$\begin{array}{r} 2078 \\ + 1825 \\ \hline \end{array}$$

$$\begin{array}{r} 2532 \\ + 2190 \\ \hline \end{array}$$

$$\begin{array}{r} 3420 \\ + 3285 \\ \hline \end{array}$$

$$\begin{array}{r} 1850 \\ + 1095 \\ \hline \end{array}$$

$$\begin{array}{r} 2555 \\ 82555 \\ \hline \end{array}$$

Dividend Return'd 11518282005, or Proof.

N. B. *The Work of the 8th. Example above, Exhibits its Proof, by Adding the last Remainder (if any happens,) and all the particular Products or Multiples together; in the same Order, as they stand in their Ranks or Series; according to the Marks or*

Distinctions

Definitions of their Crosses; by virtues of which, the Figures of each Dividual, and Remainder, is Omitted, or Left out of the Summ of that Addition; which (if Right, and orderly placed) will always be equal to the Dividend; And consequently, a true and Concise Proof to the Work.

Explication.

FOR the Satisfaction of the Reader I shall Endeavour to Explain and Apply the last Example so Conspicuously, as that all the Difficulties in Division, may be Rendered Plain and Easy to the meaner Capacity. In order to which; Let it be Required to Divide the given Dividend in Example. 8. (viz. 11518282005) by the proposed Divisor, viz. 365.

First, Set down the Number, as you see; then distinguish by a Point, a part of the Dividend; which shall be greater, than, or at least, equal to the Divisor; which is called the Dividual: Then seek how often you can have your Divisor in the said Dividual; (viz. 365 in 1151, which because it is usual the hardest Task, to find exactly; observe carefully this Rule; saying, I cannot have (3) the 1st Figure of the Divisor in (1) the 1st Figure of the Dividual; but can have it 3 times in (11) the 1st two figures of the Dividual; And there will remain (2); which I imagine to stand before (5) the third Figure of the Dividual; which therefore will make 25; Now since (6) the 2d Figure of the Divisor, can be easily had (3 times) in 25, I conclude, that I can have 3 times 365, in 1151; therefore I place 3 in the Quotient, just after the Crooked-Line, Or which is to the same Effect; I first compare the

Number

Number of Places in the *Divisor*, with those in the *Dividual* ; and find them either Equal ; Or the latter, to exceed the former, by One, If they consist in Equality ; I ask how often the 1st or extreme figure of the *Divisor*, towards the Left-hand, is contained in the 1st figure of the *Dividual* towards the same Hand ; but when it happeneth (as here it doth) that the Places of the *Dividual* exceed those in the same *Divisor*, by One ; I ask how often, the 1st figure of the *Divisor* can be had in the two first places of the *Dividual* ; And by that imagined Number, which Answers the Question (*viz.* 3) I proceed (for Tryals sake) to multiply mentally, the whole *Divisor* (*viz.* 365) thereby ; And observes that either the whole Number of Places in that Product, (*viz.* 1095) or at least two or three of them, towards the Left-hand, are less than those of the *Dividual* (*viz.* 1151) on the same Hand ; therefore I have rightly supposed, that the *Divisor*, (*viz.* 365) is contained in the 1st *Dividual* (*viz.* 1151) so many times (*viz.* 3) ; therefore I put 3 in the *Quotient*, and Multiply the *Divisor* (*viz.* 365) thereby ; writing the Product, (*viz.* 1095) orderly under the *Dividual* (*viz.* 1151) Then,

Secondly, I Subtract the Product, (*viz.* 1095) from the *Dividual* (*viz.* 1151) and write the Remainder underneath, (*viz.* 56) to which,

Thirdly, I bring down (8) the next figure to the Right-hand of the *Dividend* ; And which, shew that I have done with ; I mark, by putting a Point, under it ; so I have now (568) for a New *Dividual* ; Then, *Fourthly*, Do I again Enquire, by the Method prescribed in the 1st Article, how often I can have 365, in 568 ; Or more, briefly ; How often, 3 in 5 ; And comparing those Numbers together according to the General Rule aforesaid, as well as the first

Article, above ; and which a little Practice, will make very Easy, I find, I can have it but once ; wherefore I put (1) in the *Quotient* ; And by it, Multiply my *Divisor* ; And Subtract the *Product* thereof, (*viz.* 365) from (568), the last *Dividual* ; the Remainder, is (203) ; to which Point, and bring down the next figure (2) from the *Dividend*, make 2032, for a New *Dividual* : Then I ask, how often, 365 in 2032 ; Or more briefly ; How often 3 in, 20 ? And by Comparing my *Divisor*, with the *Dividual*, According, to Article first, I find I can have it (5 times ; wherefore, placing (5) in the *Quotient* ; by that, I multiply the *Divisor* ; (*viz.* 365) And Subscribing the *Product* orderly under the *Dividual*, (*viz.* 2032) ; Subtracting it also from thence ; And to the Remainder (which is 207) ; I point and bring down the next figure (*viz.* 8) make (2078) the next *Dividual* : Then, how often 365, in 2078 ; Or 3 in 20 ? *Answer* 5 times ; place 5 in the *Quotient* ; Multiplying Your *Divisor* thereby ; your *Product* (*viz.* 1825,) being Subtracted from, 2532 ; rests 253 ; to which Point and bring down 2 ; make 2532, for a New *Dividual*. Then how oft 365 in 2532 ; or 3 in 25 ? the *Answer*, is, 6 times ; which being placed in the *Quotient*, and (365) the *Divisor*, Multiplied thereby ; make 2190 ; which Subtracted from, 2532 ; Rest 342 ; to which point and bring down (0) the next place make 3420, for a New *Dividual* : Then how oft 365, in 3420, or 3 in 34 ? *Answer* 9 times ; which being placed in the *Quotient* ; And (365) the *Divisor*, multiplied thereby ; make 3285 ; which being Subtracted from 3420 ; Rest 135 ; to which Point and bring down (0), make 1350, for a New *Dividual* : Then how oft (365) the *Divisor* ; in 1350 ; Or 3 in 13 ? *Answer* 3 times ; which

D 3

being

being plac'd in the *Quotient*, And (365) the *Divisor* Multiplied thereby ; make 1095 ; which being Subtracted from 1350, Rest 255 ; to which Point and bring down, (5) the next Place, make 2555 for a New *Dividend* : Then Lastly ; how oft 365 in 2555 ; Or 3 in 25 ? Answer 7 times ; which being plac'd in the *Quotient* ; And (365) the *Divisor* Multiplied thereby ; make 2555 ; which being Subtracted from 2555 ; Rest (0), for the conclusion of the work ; And your *Quotient* is found to be 31556937.

N. B. The Explication of this Example, being carefully Observ'd, will be Sufficient to Teach any One the Way of Dividing readily, by two or more figures ; According to this Plain and easy Method ; by which the LEARNER, will soon become a Proficient.

OBSERVATIONS.

1. Note, When it happens, that the Product of your Divisor, by the figure, Plac'd in the Quotient, is greater than your Dividend ; then in such Case ; You must Correct your Quotient-figure ; by placing in its Room such a Lesser One ; As the Divisor being Multiplied thereby, will Exhibit a Product, either equal to the Dividend ; Or such as the Excess, may be Less than the said Divisor ; which may be found, by the 1st Article as above.

2. Note, If it happen, that the Difference between the Dividend, And the Product of the Divisor, Multiplied by the Quotient figure, is either greater, or equal to the Divisor ; the Quotient figure, is false ; And may be Rectify'd without beginning the Work again ; by dividing the Remainder by the same Divisor, and adding the New Quotient-figure arising therefrom, to the former Quotient ; the Sum of them will be the true Quotient figure desired ; And there

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then to the New or last Remainder, if any happen, must be brought down, the next place or Figure of the Dividend, for a New Dividual.

SECT. III.

Division, Exquisitely and Concisely Performed; Or the Short Italian Method.

THE last Method of Division, is principally Adapted to the Learners Capacity, for its Facility so the following is more Agreeable to the Artift for its Brevity; Especially, in the Dispatch of Business; according to the Work of the following Example, and its Explication.

Example 9.

Qu. What is the Quotient of 64988589195264 Divided by 43008? Answer 1511081408.

See the Work.

Divisor.	Dividend.	Quotient
43008	64988589195264	(1511081408

219805

47658

$\overset{3}{\underset{2}{6}}\overset{3}{X}$ 46509

3 350119

60555

175472

344064

Remains (0).

Proof.

Proof.

Admit 'tis 'Requir'd to Prove this Example or any other in *Division*, by the Cross: you must Cast away 9 from the *Divisor*, as oft as may be; And place the *Remain*, at one Angle of a Cross; And the *Remain*, in like sort, being cast from the *Quotient*, let it be plac'd, at the Opposite Angle thereof; then Multiply both those *Remains* together; And to the Amounting Number; add the *Remain* of the *Division*, if any be; And if the Total be under 9; place it at another Angle of the Cross; but if above 9 cast away 9, as before, and set down the Residue: Lastly, cast away all the Nines from the *Dividend*; And set the last *Remainder* Opposite to the *Remain*, last before set down: which if the Work be Right, will be Equal thereto; otherwise not; tho' by this Proof; sometimes a false *Quotient* as well as *Product*, will be Affirm'd to be true; therefore, tho' its much us'd in Schools; by Reason, of its Brevity; Yet (for certainty) it is more preferable, to Multiply the *Quotient* found, by the *Divisor*; taking in the *Remainder*, if any be; the *Product* will be Equal to the *Dividend*.

Explication.

FIRST, In this Example, the given *Dividend* is 6,988,89,95264; to be Divided by 43008, in order to find the *Quotient*: To Effect which; let there be Set.led for the 1st *Dividual*, five places; by putting a Point under 64938 the 5th. Figure of the *Dividend*; because there are just so many Places in the *Divisor*; And that (4) the 1st Place thereon the Left-hand is less, than that of, (9) the *Dividual*.

Secondly,

Secondly, I Ask how often the *Divisor* (*viz.* 43008) is contained in the *Dividual*, (*viz.* 64988) ; Or more brief, how oft 4 in 6 ; the Answer is 1 ; to be placed in the *Quotient* : then instead of saying, Once 43008 is so much ; and putting it under 64988 I subtract it therefrom, without having occasion, (as it here happens) to borrow Ten to any Digit of the *Dividual* ; And there Remains 21980 : to which I point and bring down (8) the next figure of the *Dividend* ; make 219805, for a New *Dividual*.

Thirdly, Seeing the last *Dividual*, hath one place more than the *Divisor* ; I ask how often 4 is contained in 21 ? the Answer is 5 times ; which being placed in the *Quotient* ; I Multiply the *Divisor* thereby ; And proceed to Subtract gradually, as I Multiply ; by saying 5 times 8 is 40, 0, and carry 4 ; then 0 from 5 ; rest 5 ; which place under ; then, 5 times 0, is 0, and 4 that I carried is 4 : from 0, I cannot, but 4 from 10 ; rest 6 ; which put under ; then 5 times 0, is 0, and 1 I borrowed from 8, rest 7 ; which place ; then 5 times 3 is 15 ; 5 and carry 1 ; then 5 from 9, rest 4 ; which put under ; then 5 times 4 is 20, and 1 I carried is 21 from 21 Rest 0, Then to the *Remainder* 4765 I point and bring down the next figure in the *Dividend*, *viz.* 8 ; which make 47658 for a New *Dividual* ; then say how often 43 in 47 ? the Answer is 1 which I set in the *Quotient* ; saying once 8 is 8 ; from 8 ; Rest 0 ; which place ; then 1 time 0, is 0 ; from 5, Rest 5 ; which set under ; then 1 time 0 is 0 ; from 6 ; which place ; then 1 time 3, is 3, from 7 ; Rest 4 ; which set under ; then 1 time 4 is 4 ; from 4 ; Rest 0 ; or 4650 ; to which point, and bring down 9 ; the next figure in the *Dividend* make 46509 for a New *Dividual* ; And then proceeding orderly, as before ; untill all the figures of the *Dividend*, are

D 5

thus,

thus Pointed, and Successively brought down : So will the Compleat *Quotient* be 5511081408, And 0, Remain ; As in the Work, which see.

Observations.

1. Note, *Albeit* the 2d. or last Method, appears to be some what Easier to a Beginner or Learner, than this ; Yet the above nam'd to an Artist, is more preferable for its Brevity ; by Reason ; that a Multitude of Useless Figures are here Avoided ; And the Work prevented from an unseemly Length ; especially, when the Dividend and Divisor, are very Large ; therefore, this Method (as above) ought to be well Understood ; for the more ready performing Examples Adapted to Business.

2. Note, There are several Ways by which this difficult Rule of Division may be perform'd ; but none (that I know of) so plain, Easy, and Concise, as well as Curious ; than those which are so variously treated of in the three Sections, above ; with their Explanations ; whose Operations Proof, Use and Application ; are Render'd so perspicuous and Intelligible to the Capacity of any Learner ; that there needs but only for Practice those 3 Examples, foregoing, to make him an Artist herein ; And that only by Transcribing them, particularly upon waste Paper ; And Comparing each Operations, carefully, with its Explication.

3. Note, The Reader may here Observe that as the Author's Method of Division, is now become Antiquated ; Yet for the sake of such as are Accustom'd to it, as well, as for securing unto the Publick the Author's Works without Alteration ; further than only needful and proper Corrections, &c. And for Rendering them more Compleat, as well as Useful to the present Age ; those Three various Kinds of Division,

are Added, in order to the more Accurate Performance of Business.

Questions Propounded for the Learner's Exercise and Improvement.

Example. IV.

IN 12435282984960000 Square Yards; how many Square Miles; when 3097600 Square Yards, is contained in 1 Square Mile? *Answer* 4814489600 Square Miles.

Example. V.

How many Pieces of Gold at 19 s. Sterling per Piece, must a Merchant in *Amsterdam*, Remit to another in *London* for 1106042 Shillings, Sterling there Received? *Answer* 58212 $\frac{1}{2}$ Pieces.

Example. VI.

A Commonality Pays a certain Man the Summ of 2537157427257 Crowns; upon Condition that at the Time Appointed he should Return them 632 Crowns, for every Crown lent; The Question, is what Summ was Lent?

Answer 4144896000 $\frac{2}{3}$ Crowns Lent.



CHAP. VII.

REDUCTION.

A^r S for *Reduction*, although it be no Rule absolute of it self, but merely wrought by *Multiplication* and *Division* (as I have here manifested in a plain manner). yet I think good (not altogether to omit it, lest any should censure me for so doing, in regard it is very usually practised), to deliver somewhat therefore concerning it.

Reduction teacheth one to bring all gross, or great Denominations into small, and small into great.

First, all great Denominations are brought into small by *Multiplication*, as

Pounds multiplied by 20, are shillings.
Shillings multiplied by 12, are pence.
Pence multiplied by 2, are half pence.
Pence multiplied by 4, are farthings.
Pounds multiplied by 240, are pence.
Pounds multiplied by 480, are half pence.
Pounds multiplied by 960, are farthings.
 Secondly, all small Names are brought into great by *Division*. As,

Shillings

Shillings divided by 20 are pounds.

Pence divided by 12 are shillings.

Half-pence divided by 2 are pence.

Farthings divided by 4 are pence.

Pence divided by 240 are pounds.

Half-pence divided by 480 are pounds.

Farthings Divided by 960 are pounds.

1000

20

20000.

12

240000 d.

4

960000 qrs.

1. Consider whether the sum propounded, be brought into a greater or lesser denomination.

2. Consider how many of the one, can make the other, as here; how many shillings can make a pound *viz.* 20; and *contra*, how many shillings a pound makes *viz.* 20. Therefore, of necessity there must be 20 times so many, which being multiplied by 20, makes 20000 shillings; and by 12, 240000 pence; and by 4, *facit* 960000 farthings; as in the Example.

In 960000 farthings, how many pence, shillings, and pounds?

4) 960000. qrs.

12) 240000. d.

20) 20000. s.

1000 l. *facit*

Otherwise

Otherwise by the Author as follows, thus,

X'
9600000 (2400000 (2000) 0 s.

4444444 X'ZZZZZ 1000 l. *facit.*
X'X'X'X'

To bring Shillings into pounds, (or to divide by 20), cut off the first Figure towards the right-hand, with a dash of the Pen; and take half of the remaining Figures.

In 8471213 farthings, how many pence, groats, and nobles?

33' (1' X3XZ (1'
847XZX3' (ZX'X7803' (52945 (0
444444444 444444444
facit 26472 Nobles.

Or more briefly, thus.

4) 8471213. *grs.*

4) 2117803 $\frac{1}{4}$ d.

20) 52945 (0 $\frac{3}{4}$ *Groats.*

24472 $\frac{1}{2}$ *Nobles facit.*

Here you see the sum is to be brought into a greater Denomination, than it self; which is therefore to be done by *Division*.

Then you are to Consider what your *Divisor* must be, which is here 4; because 4 farthings make a penny; and as often as 4 is contained in the said Sum, so many pence there are

Your

Your farthings then being brought into pence, consider the next Denomination, what it is ; and how many of the former make one of it ; as how many pence make a groat, *viz.* 4 ; and look how many times 4 is contained in the sum ; so many groats there are.

Having, brought the pence thus into groats, endeavour to bring them into nobles ; by considering how many groats make a noble ; *viz.* 20 ; therefore divide by 20 ; (by cutting off the first Figure towards the right-hand ; and taking the half of the rest) and your Quotient will be Nobles.

I shall say no more as to Reduction of Money ; only leave two or three Questions for the Learner to practise upon

In 100 *l.* how many *q. d. s.* 3 *d.* and 9 *d* ?

In 47162 Marks, how many Nobles, Pounds, Groats, Farthings, 6 *d.* and 2 *d* ?

In 7665 *l.* 11 *s.* 10 *d.* how many shillings, pence ; and pounds, farthings, crowns, and ob ?

Reduction of Cloth Measure.

11. *Observe in this, and all the Reductions following, how many of the one Denomination do make one of the other ; and so multiply or divide, according to the two Rules foregoing, in Reduction of Money.*

In 4372 yards how many *qrs.* and Ells Flem ?

$$\begin{array}{r} 4 \\ \hline 17488 \text{ qrs.} \\ \hline \end{array}$$

Or thus ;
4372 Yards ;

+ 4

3) 17488. *qrs.*

2 2 (1 5829½ Ells Flem facit.

47488 (1829 facit.

3333

In

In 7862 Ells. Eng. how many qrs. and yards ?
5 Answer 982, $\frac{1}{2}$ Yards.

39310 qrs.

Or thus ;
 7862 Ells Eng.

+ 5

4) 39310. qrs

facit 9827 $\frac{1}{2}$ Yards.

3 13' (2

3 316 (9827 $\frac{1}{2}$ Yards facit.

4444#

In 85 pieces, each 19 Ells $\frac{2}{3}$ how many quarters, mals, and yards ?

Reduction of Wine Measure.

III. In 55 tuns ; how many hogheads, gallons, 1
 pottles, quarts and pints ?

35 Tuns

4

140 hogh.

63

42

84

8820 gallons.

4

35280 quarts.

2

70560 pints.

In

I. Chap. VII. *Reduction* 65

In 4712568 pints, how many gallons, and Run-
 ders, each 11 gallons?

In 327 Barrels, each 32 gallons, how many hog-
 heads and runs?

Reduction of Time.

IV. In 1659 years; } 365 days a year.
 how many days, hours, } 24 hours a day.
 and minutes? } 60 minutes an hour.

1659 years.

365

8295

9954

4977

605535 days.

24

2422140

1211070

14532840 hours.

60

871970400 minutes.

In 87167155 minutes; how many hours, days,
 and years?

In 20 years and a half, how many days, hours,
 and minutes?

Redu-

Reduction of Land Measures.

8 Furlongs a Mile.
 40 Poles a Furlong.
 16 $\frac{1}{2}$ Feet, a Pole.
 3 Feet a Yard.
 12 Inches a Foot;
 3 Barley Corns an Inch.
 Corns,

100 miles.

8

800 furlongs.

40

32000 Poles.

33

96000

96000

 $\frac{1}{2}$ 1056000 half feet.

528000 feet.

12

6336000 inches.

3

19008000 barley corns.

Reduction of Troy-Weight.

VI. In 87 pound and $\frac{1}{2}$ how many ounces, penny weight, and grains?

$$\begin{array}{r}
 87 \text{ lb } \frac{1}{2} \\
 12 \quad \text{---} \\
 \hline
 174 \\
 876 \\
 \hline
 1050 \text{ Ounces} \\
 20 \quad \text{---} \\
 \hline
 21000 \text{ dw.} \\
 24 \quad \text{---} \\
 \hline
 84 \\
 42 \quad \text{---} \\
 \hline
 50400 \text{ grains.}
 \end{array}$$

In 7151213 grains, how many penny-weight, ounces and pounds?

In 15 Ingots, each 7 pound and $\frac{1}{2}$, how many ounces, penny-weight, and grains?

Reduction of Avoir du poids Weight.

VII. In 96 C. weight, how many grs. lb and (3)

⁴
384 quarters.
28

—
3072
768

—
10752 pounds.
16

—
64512
10752

—
172032 ounces.

In 40 C $\frac{1}{2}$ 19 pounds, 11 ounces, how many grs. lb. and ounces?

—
4
162 quarters.
28

—
1305
325

—
4555 pounds.
16

—
27331
4556

—
72891 ounces.

In 8714 ounces, how many pounds, quarters, and C? *facit.*

In

Ba

ber

to

Ba

19

1

kno

kno

plie

gar

1

poun

In

In 20 Bags, each 3 C. $\frac{1}{2}$, how many grs. and pounds?

$$\begin{array}{r}
 4 \\
 \hline
 14 \\
 28 \\
 \hline
 112 \\
 28 \\
 \hline
 392 \text{ pounds in one.} \\
 20 \\
 \hline
 7840 \text{ pounds in all.} \\
 \hline
 \end{array}$$

Where you find the word [each] have a special regard to it, and reduce the Particulars which it implies; first into one Denomination; then when you know how much is contained in one, you may easily know how much is in all.

In 36 Barrels of Figs; each 3 C. $\frac{1}{4}$ grofs; Tare 19 pound per Barrel; how many Pounds near?

Whether the word [Tare] imply per Bag, per Barrel, or per C. &c. it is all, as one, if you keep to your former Rule in Multiplication by observing which, you cannot miss of what you would know; as here Tare 19 pounds per Barrel?

Say, if 1 Barrel give 19 pounds, what 36 Barrels?

Mul-

Multiply 19 and 36 together, and the Product is pounds Tare; then subtract the pounds Tare from the pounds Gross; and the Remains are Pounds Neat.

36 Barrels	
19 Tare for 1 Barrel.	
324	
36	
684 Tare in all.	

3 C. $\frac{3}{4}$	
4	
13	
28	
104	
26	
364 pounds in one Barrel.	
36	

2184	
1092	
13104 pound Gros.	
684	
12420 pound neat.	

In 45 Bags of, £s. each 17 C. $\frac{1}{4}$ gros; Tare 15 pounds *per* Bag, how many C Neat?

In 47 C. $\frac{1}{2}$ Gros; Tare 17 pounds *per* C. how many pounds neat?

In

Chap. VII. Reduction.

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In 5 Hogheads of Tobacco each containing as followeth, how many C. neat? viz.

	C. grs.	lb.	lb.
Number	$\left. \begin{array}{r} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} \right\} \text{Containing}$	$\left. \begin{array}{r} 4-2-11 \\ 3-1-12 \\ 2-3-16 \\ 4-1-23 \\ 3-2-27 \end{array} \right\}$	$\left. \begin{array}{r} 63 \\ 76 \\ 5 \\ 75 \\ 64 \end{array} \right\} \text{Tare}$

In 57120 C. $\frac{1}{2}$ of Lead, how many Fother at 19 C. $\frac{1}{4}$?

In 5671 Pigs of Lead, each 7 C. $\frac{1}{2}$, how many Fother at 19 C. $\frac{1}{4}$? *Answer.* 2181 $\frac{6}{3}$, *facit* 2181 Fother $\frac{6}{3}$,



CHAP. VIII.

Numeration of Fractions.

THE next Thing to be treated of, are, Fractions.

1. Concerning which, I shall shew what a Fraction is.

2. How it is exprest.

3. How many sort of Fractions there are.

A Fraction, or broken Number, is a part or many parts of a whole Number: For as whole Numbers ke their beginning from one, and continue in Number without end, so the said whole Numbers by imagination, may

72 Numeration of Fractions. Ch. VIII.

may be dissolved or broken into pieces or parts infinite.

Therefore to attain the knowledge of them, acquaint your self with these two Terms, Numerator and Denominator.

The Numerator expresseth the number of the parts.

The Denominator giveth those parts their names,

1	2	3	Numerator.
—	—	—	
2	3	4	Denominator.

$\frac{1}{2}$ is the one half of any thing.
 $\frac{2}{3}$ is two third parts of any thing.
 $\frac{3}{4}$ is three quarters of any thing.
 $\frac{4}{5}$ is four five parts of any thing.

Fractions of Fractions.

Fractions of Fractions have commonly this word (of) between them, as $\frac{2}{3}$ of $\frac{3}{4}$, that is, two third of three quarters.

Improper Fractions.

If the Numerator be greater than the Denominator, the Fraction is improper, and containeth a Unite or Unites; or some part or parts of the Denominator, as $\frac{1}{4}$ is 3 Integers, or whole., and 3 quarters; but when the Numerator and the Denominator are alike, they make a Unite.

Though Addition in whole Numbers be immediately after Numeration; yet in Fractions, it is not so; because there are, as here you see, Fractions of several sorts; which must of necessity be reduced into one Denomination, before they can be added

IX. Reduction of Fractions. 73

aded. Therefore to avoid disorder I shall first shew, what this Reduction of Fractions is ; secondly ; how to reduce all Fractions to one Denomination, or Likeness.

CHAP. IX.

Reduction of Fractions.

What Reduction is.

1. **R**eduction teacheth to bring Integers into Fractions ; or contrary ; yea, Fractions of divers Denominations into one ; or what you list.

I would have reduced $\frac{1}{2}$ & $\frac{3}{4}$ of an Ell ; or what you please into one Denomination.

II. To reduce proper Fractions.

For the effecting of this, and all other of this kind ; Multiply all the Denominators together ; (which Product take for a common Denominator) as 2 times 3 is 6, and 4 times 6 is 24, your Denominator.

Then multiply the Numerator of the first in all the other Denominators, except its own Denominator ; as once 3 is 3, 3 times 4 is 12 ; which take for a new Numerator to the first Fraction.

Then multiply the second Numerator in all the Denominators, except its own ; as 2 times 2 is 4, and 4 times 4 is 16 ; which likewise take for a new Numerator to the second.

E

Then

74 Reduction of Fractions. Ch.

Then Multiply the third Numerator in the Denominators, except its own ; as 3 times 2 is 6, 2 times 9 is 18 ; which also place for a new Numerator to the third, and your work standeth thus.

$$\begin{array}{r} 12 \quad 16 \quad 18. \quad \text{So that } \frac{12}{24}, \frac{16}{24}, \frac{18}{24} \\ \hline \frac{1}{2} \quad \frac{2}{3} \quad \frac{3}{4} \text{ are equal to } \frac{1}{2}, \frac{2}{3}, \frac{3}{4}. \\ \quad \quad \quad 24 \end{array}$$

II. To Reduce Fractions of Fractions, into one Denomination.

Multiply all the Numerators together, and take the Product thereof for a new Numerator ; and likewise multiply all the Denominators together ; and make the Total a Denominator.

6

Example, $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{1}{4}$

24

III. To Reduce improper Fractions into whole Numbers.

Divide the Numerator by the Denominator.

Answer $5 \frac{3}{4}$

Example.

$7 \frac{3}{4}$

Or thus ;

4) $23 \left(5 \frac{3}{4} \right.$ facile

$23 \frac{3}{4}$

IV. To reduce a whole Number into an improper Fraction.

Let the number given be the Numerator and the Denominator.

Example

Ch. IX. Reduction of Fractions. 75

Example. Reduce 13 Integers into an improper Fraction.

V. To reduce a whole Number joyned with a Fraction, into one Denomination.

Multiply the whole Number, into the Denominator of the Fraction, adding thereto the Numerator.

Example. 5 yards and $\frac{3}{4}$ facit $2\frac{3}{4}$.

VI. To reduce a greater Fraction into lesser terms, equivalent to itself.

Take the half of the Numerator, and half of the Denominator; as oft as you can, and when you can take the half no further; take the one third, or the one fourth, or the one fifth, &c. both of the Numerator and Denominator.

Example.

I would abbreviate $\frac{1}{2}\frac{4}{8}\frac{2}{6}\frac{3}{9}\frac{5}{10}\frac{7}{14}\frac{11}{22}$

Take the half of 24, which is 12, then the half of 120, which is 60, again the half of 12, which is 6; and the half of 60 is 30, then the half of 6; is 3; and the half of 30 is 15: here you see that the half cannot be taken both of the Numerator and Denominator, therefore try whether it will be abbreviated by 3, as thus: How many times 3 in 3, once, then how many times 3 in 15, five times. So that $\frac{1}{3}$ is in the lowest Denomination yet it retains the same value; for $\frac{1}{3}$ is equal to $\frac{2}{6}$.

A second kind of Abbreviation.

Though by the former Rule, all Fractions might be abbreviated; yet when you cannot take $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{8}$, or $\frac{1}{9}$. &c. They seem

E 2

more

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more tedious than by this second way, as may appear.

I would have this sum abbreviated, $\frac{3072}{4172}$ into a lesser Fraction.

For the reducing whereof ; divide the Denominator by the Numerator ; and the remain of the Division will be 1086 ; by which divide the former Divisor, -3077 ; and there will remain 905 ; by which divide your last Divisor 1086, and there will remain 181 ; by which remain likewise divide the Divisor 905 ; and there will remain 0.

Where note, That having divided your Denominator by the Numerator ; and the Divisor of every Division so often by the Remains, that nothing will remain ; Then that last Divisor will divide both your Numerator and Denominator of your Fraction.

As in the Example.

$\frac{3072}{4172}$ facit, $\frac{17}{23}$ equal to the former.

How to reduce, or alter any Fraction to another Denomination ; as Money, Weight, or Measure, &c.

Multiply the Numerator by such a new Denominator, or Number which you intend ; dividing the Product by the former Fraction's Denominator ; whose Quotient shall be a Numerator to the Denominator last chosen.

Example.

What is $\frac{2}{3}$ of 12 d. $\frac{24}{3}$ d.

Or thus ; $12 \div 3 = 24 \div 3$ 8.

$24 \div 3$ (8 d.

What is $\frac{1}{2}$ of 20 Shillings ?

What is $\frac{2}{7}$ of a Flem. Ell ?

What

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What is $\frac{1}{4}$ of a Yard?

What is $\frac{1}{6}$ of a Tun of Wine?

What is $\frac{2}{7}$ of a Tun of Iron?

What is the $\frac{1}{17}$ part of a Hoghead of Sack?

What is $\frac{1}{4}$ of a Dollar at 4 s. 8 d.

facit 44 d. $\frac{1}{4}$.

What is $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{1}{5}$ of 5 Shillings? *facit.* 1 $\frac{3}{4}$ or 1 $\frac{1}{4}$

24

Reduce Fractions of Fractions to one single Fraction, and work as before.

$$\frac{\frac{2}{3} \times \frac{1}{2} \times \frac{1}{4}}{\frac{1}{4}} \text{ of } \frac{1}{8} \text{ (1 s. 8 d. } \frac{1}{4} \text{)}$$

What is $\frac{1}{4}$ of a Dollar at 4 s. 8 d.
facit. 44 d. $\frac{1}{4}$.

CHAP. X.

Addition of Fractions.

1. **A** Ddition of Fractions, is the putting of two or more broken numbers into one sum, or principal Fraction.

In this Rule, and the next, observe, that all Fractions whatever, proper, or improper; must be of one Denomination, or reduced thereto by the former Rules.

2. Being of one Denomination only, add all the Numerators together, which Total, subscribe for

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for a new Numerator over the common Denominator.

Example.

Add $\frac{2}{3}$ and $\frac{1}{3}$ of any thing together.
 $\frac{2}{3}$ and $\frac{1}{3}$ *facit* $\frac{3}{3}$, or one whole one.

326

60 80, 90 | 96

Add, $\frac{1}{2}$ $\frac{2}{3}$ $\frac{1}{3}$ $\frac{2}{3}$ together *facit* $1\frac{1}{3}$.

120

Reduce them into one Denomination, by the first Rule of Reduction; then add the Numerators, as in the last Example.

II. A more speedy way.

Multiply all the Denominators that differ in quantity each from other, and the Total thereof shall be the common Denominator, and Dividend to each particular Denominator; whose *Quotient* multiply into its Numerator; and set it directly against its own Fraction; and, *in fine*, add them all up; which Total shall be a new Numerator unto the common Denominator; and add as many Integers as they make to the whole Numbers.

Example.

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Example.

$$\begin{array}{r}
 \text{Hb} \quad (24) \text{ or } 12 \\
 620\frac{1}{4} \quad 3 \\
 271\frac{1}{3} \quad 4 \\
 103\frac{1}{2} \quad 6 \\
 017\frac{1}{4} \quad 9 \\
 710\frac{1}{2} \quad 6 \\
 \hline
 1723\frac{1}{2} \quad 1\frac{1}{2} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 4 \\
 28 \\
 \hline
 32
 \end{array}$$

III. Yet a more short way.

Cast your Eye upon the Denominators ; and imagine what number will be divided by them all and that shall be your common Denominator and Dividend unto each particular Denominator ; then work as before in the last Example.

Number 12 will be
divide by all the
Denominators.

$$\begin{array}{r}
 472 - \frac{2}{6} \\
 315 - \frac{1}{4} \\
 917 - \frac{1}{6} \\
 106 - \frac{2}{3} \\
 317 - \frac{1}{2} \\
 125 - \frac{1}{4}
 \end{array}$$

$$\begin{array}{r}
 2308 - \frac{1}{6} \\
 \hline
 10
 \end{array}$$

$$\begin{array}{r}
 34 \\
 \hline
 12
 \end{array}$$

IV. Addition of Fractions.

Reduce your Fractions into a single Fraction, according to the second Rule in Reduction, then work, as before.

E 4

Example

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Example: Add $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{4}{5}$ unto $\frac{4}{7}$ of $\frac{6}{7}$.

$$\begin{array}{r|l} 6 & 24 \quad | \quad 210 \quad | \quad 576. \\ \hline \frac{1}{2} \text{ of } \frac{2}{3} \text{ of } \frac{4}{5} \text{ unto } \frac{4}{7} \text{ of } \frac{6}{7} : & \frac{6}{27} \quad \frac{24}{37} : \quad \frac{210}{786} \end{array}$$

$$\begin{array}{r|l} 24 & 35 \quad | \quad 840 \text{ facit } \frac{786}{17} \end{array}$$

V. Addition of improper Fractions.

Reduce your Fractions into one Denomination, and work as above:

Example. Add $\frac{4}{5}$ and $\frac{2}{7}$

$$\begin{array}{r|l} 30 & 28 \\ \frac{4}{5} & \frac{2}{7} \text{ facit } \frac{52}{35} \text{ or } 2\frac{2}{35} \\ \hline 24 & \end{array}$$

VI. To add a single Fraction unto a Fraction of Fractions.

Example: Add $\frac{1}{2}$ and $\frac{1}{3}$ of $\frac{4}{5}$ together; $\frac{1}{2}$ of $\frac{4}{5}$ reduce into a single Fraction; according to the second Section in page 72, and work as before.

$$\begin{array}{r|l} 4 & 16 \quad 45 \\ \hline \frac{1}{2} \text{ of } \frac{4}{5} & \frac{1}{2} \text{ and } \frac{4}{5} \text{ facit } \frac{8}{5} \\ 15 & \end{array}$$

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C H A P. XI.

Subtraction of Fractions.

I. **S**UBTRACTION is the taking of one Fraction from another; a less from a greater; or an equal from an equal.

1. Because Subtraction teacheth to take a lesser Fraction from a greater, it will not be amiss to shew you how to know the one from the other.

2. Those Fractions are accounted the greatest, whose Numerator, multiplied by the Denominator of the other's Fraction, maketh the greatest Number.

And as in *Addition*, so here, all Fractions to be subtracted must be of one Denomination, or reduced therunto.

II. To subtract Fractions of one Denomination, whose Denominators are Equal.

Subtract one Numerator from the other, and set the Remain over the common Denominator.

Example.

Subtract $\frac{2}{5}$ from $\frac{3}{5}$ there remains $\frac{1}{5}$.

III. To subtract a whole Number and a Fraction; from a whole Number and a Fraction.

First, reduce your Fractions into one Denomination; then subtract the one Numerator from the other; and from the Integer, subtract as you were taught in whole Numbers.

Example.

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Example.

Received 30 $l.$ $\frac{3}{4}$, Laid out 10 $l.$ $\frac{1}{2}$

$$\begin{array}{r} \text{2} \\ \hline 6 \quad 4 \\ \frac{3}{4} \quad \frac{1}{2} \text{ Remains } \frac{5}{4} \text{ or } 1 \frac{1}{4} \\ \hline 8 \end{array}$$

IV. Another Way.

Multiply the Denominators together, and let the Product be the common Denominator, which common Denominator divide by each particular Denominator, and multiply their Quotients by their Numerators, and set down their Products directly against its Fraction, and then subtract as if it were in whole Numbers.

As for Example.

$$\begin{array}{r} \text{Received} \text{---} 100 \text{ } l. \quad \frac{3}{4} \quad 25 \\ \text{Spent} \text{---} 93 \text{ } l. \quad \frac{1}{2} \quad 18 \\ \hline \text{Remains} \text{---} 7 : \frac{5}{4} \end{array}$$

V. When the Fraction to be subtracted, is greater than the Fraction you are to subtract from

Reduce them into one common Denominator (as you did in the last Example) and subtract the greatest Numerator from the common Denominator, and add the Remains to the Numerator of the less, which subscribe for a new Numerator unto the common Denominator; then carry one to the next Integer, and subtract as in whole Numbers: Received

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l. s.
 Receiv'd 5 --- 0
 Paid --- 3 --- $\frac{2}{3}$
 Remains 1 --- $\frac{1}{3}$

C.
 Bought --- 16 $\frac{1}{4}$ 7
 Sold --- 14 $\frac{1}{4}$ 12
 Remains 1 $\frac{2}{4}$ $\frac{5}{8}$

VI. When Fractions of Fractions are to be subtracted, they must be reduced into single Fractions then subtracted as before.

Example. $\frac{1}{2}$ of $\frac{2}{3}$ to be subtracted from $\frac{1}{4}$ of $\frac{4}{5}$ being reduced into single Fractions, they are $\frac{2}{3}$ and $\frac{1}{5}$.

$$\begin{array}{r} \frac{5}{4} \\ 15 \end{array} \quad \frac{9}{4} \text{ Remain } \frac{4}{5}$$

CH A P. XII.

Multiplication of Fractions.

I. IN Multiplication of Fractions, whether they be proper, improper, mixt, or compound, they must likewise be reduced to single Fractions, Multiply the Numerators therefore together, and the Product shall be a new Numerator; then multiply all the Denominators, and the Product thereof shall be the Denominator.

Example
 Multiply $\frac{2}{3}$ by $\frac{3}{4}$ $\left| \begin{array}{r} 6 \\ 2 \times 3 \text{ facit } 1 \frac{5}{2} \text{ or } \frac{7}{2} \end{array} \right.$

It might seem somewhat strange to young Learners, that $\frac{2}{3}$ of a Pound being multiplied by $\frac{1}{4}$ of a Pound

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Pound, should make but $\frac{2}{3}$: Therefore to inform them I think meet to acquaint them, that as whole Numbers multiplied by whole Numbers, do increase the Product: so proper Fractions multiplied by proper Fractions do diminish the Product: For as 1 multiplied by 1 makes but 1; so that which is less than 1 being multiplied by that which is less than 1; must needs make less than either of them: Or thus,

$$\begin{array}{r} \frac{3}{4} \\ \frac{2}{3} \\ \hline 1 \frac{1}{2} \end{array}$$

To Multiply Fractions of Fractions.

II. Reduce them into single Fractions, then work as before.

Example. $\frac{2}{3}$ of $\frac{1}{2}$ by $\frac{1}{3}$ of $\frac{2}{3}$ being reduced, they are $\frac{1}{2}$ and $\frac{1}{3}$, and being multiplied, *facit* $\frac{1}{6}$

To multiply a whole Number and a Fraction together.

III. Multiply the Numerator by the whole Number, and divide the Product by the Denominator.

Example. Multiply 4 by $\frac{3}{4}$ *facit* 3 *facit*.
K

To multiply a whole Number and a Fraction by a whole Number.

IV. Reduce the whole Number and Fraction into an improper Fraction, then work as before.

Example. 2 and $\frac{2}{3}$ by 4 *facit* $3\frac{2}{3}$, OR 10 $\frac{2}{3}$.

Ch. XII. Division of Fractions. 65

To multiply a whole Number and a Fraction by a whole Number and a Fraction.

Reduce each of them into an improper Fraction, and work as before in *Set. I.*

Example. Multiply 3 and $\frac{1}{2}$ by 2 and $\frac{1}{3}$.
 $\frac{13}{2}$ by $\frac{7}{3}$ *facit* $\frac{91}{6}$ or $15 \frac{1}{6}$.

C H A P. XII.

Division of FRACTIONS.

I. **A**S in Multiplication, so in this; all Fractions, that are to be divided, must be reduced to single Fractions both for the Dividend or Divisor: Then set that Fraction, which is the Dividend, on the left Hand, and that for Divisor on the right Hand; then multiply cross-wise the Numerator of the Dividend by the Denominator of the Divisor, and subscribe the Product for a new Numerator: Likewise multiply the Denominator of the Dividend by the Divisor's Numerator, and the Product shall be a new Denominator.

Example.

What is the Quotient of $\frac{4}{3}$ divided by $\frac{2}{3}$

Place your Fractions thus, with in this X Character between them, and work according to the Directions before given, $\frac{4}{3} \times \frac{3}{2}$

Facit $1\frac{2}{2}$, or $1 \frac{4}{2}$ whole one, and $\frac{1}{1}$

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I demand the Quotient of $\frac{2}{3}$ divided by $\frac{1}{4}$?

$$\begin{array}{r} 2 \times \frac{1}{4} \\ \hline \text{Facit } \frac{2}{3} \end{array}$$

In the Division of whole Numbers, the Dividend must be always greater than the Divisor, otherwise you can make no Quotient. But in Division of Fractions it is otherwise, as in the second Question pronounced, $\frac{2}{3}$ to be divided by $\frac{1}{4}$, for $\frac{2}{3}$ is greater or more than $\frac{1}{4}$, yet it may be divided: For as the Multiplication of proper Fractions (as we said before) doth diminish the Product; so Division of proper Fractions doth increase the Quotient.

II. To divide a whole Number by a Fraction.

I demand the Quotient of 20 divided by $\frac{1}{2}$?

20 Being the whole Number, convert it into an Improper Fraction, by placing an Unit for a Denominator, and it standeth thus:

$$\begin{array}{r} \frac{1}{2} \times 20 \\ \hline \text{facit } 40 \end{array}$$

III. To divide a whole Number and a Fraction by a whole Number and a Fraction.

I demand the Quotient of 5 and $\frac{1}{2}$ divided by 3 and $\frac{1}{4}$?

$$\begin{array}{r} 1\frac{1}{4} \times 1\frac{1}{4} \\ \hline \text{facit } 14 \end{array}$$

IV. To

IV. *To divide Fractions of Fractions.*

I demand the Quotient of $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ divided by $\frac{1}{2}$ of $\frac{1}{2}$?

Reduce the dividend into one single Fraction, and likewise the Divisor ; then work as before.

$$\frac{\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4}}{\frac{1}{2} \times \frac{1}{2}} \text{ facit } \frac{3}{4}$$

CH A P. XIV.

The Rule of Three.

I. **T**HE Rule of *Three* is commonly called *The Golden Rule*; and indeed it may rightly be so termed; for as Gold transcends all other Metals; so doth this Rule all others in Arithmetick.

II. Now for your better Information concerning it; you must observe, that there are Three Numbers known, by which a Fourth that is unknown may be found out, which bears like Proportion to the third, as the second doth to the first.

III. Here also is to be noted, that if your Sums consist of sundry Denominations, then the first and third Numbers must be of the same Denomination, as also the fourth and the second: As thus, If the first Number be Yards; the third likewise must be Yards; if the second be Pence, then the fourth must be Pence.

IV. But the greatest Difficulty lieth in stating the Question.

Therefore, observe first; That what you desire to know, or to be resolv'd in the Question, must be your third

third Number : And you have commonly these Words before it, as, *What cost ? How long ? How broad ? How much ? How deep ?* &c.

2. Your Question being stated, bring your first and third Numbers into one Denomination.

3. Bring your second into the least Nomenclation'd, or as low as you desire the Question to be answer'd in.

4. Observe whether your third Number *requires more or less ; if more*, then multiply the middle Number by the greater of the two Extremes, and divide by the lesser, and the Quotient answereth the Question.

But if it require *less*, then multiply the middle Number by the lesser of the two Extremes, and divide by the greater.

These two Words, *more or less*, being well observ'd, the Scholar will understand what he doth, and need not to make two distinct *Rules of Threes*, as most do.

The four first Questions are stated four several ways, by which the one is a Proof of the other.

And thus you may easily work all the rest, which will be advantageous to the Scholar, and likewise an Ease to the Master ; I shall therefore only give you the *Facis* of the following Questions. *Ans.* 20 s.

If 5 Yards cost 10 s. what 12 Yards ?

10

—

120

120 (20 Shillings or 1 l.

86

If 12 Yards — 20 s. — 6 Yards ? *Ans.* 10 s.

20

120 (10 s. facit —

120

1

H

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If 20 s. buy 12 Yards, what will 10 s ? *Ans* 6 Y.

12

120

$\cancel{20} \cancel{0}$ (6 Yards facit.

$\cancel{2} \cancel{0}$

If 10 s. — 6 Yards — 20 s ? *Ans*. 12 Y.

6

120

$\cancel{20} \cancel{0}$ (12 Yards facit.

$\cancel{2} \cancel{0} \cancel{0}$

$\cancel{2}$

N. B. That in all the Analogies above, as well as those that follow, the Modern, or Italian Way of Division, may be Concisely Used, in stead of the Scratch'd, Practis'd here by the Author.

If 6 Men will be finishing a Piece of Work 10 Days, how long will 12 Men be doing the same ?

Men.

Days.

Men.

6 ————— 10 ————— 12 *A. 5 D.*

10

—————

60

$\cancel{60} \cancel{0}$ 5 Days facit

$\cancel{6} \cancel{0}$

If 12 Men — 5 Days — 6 Men ? *A. 10 D.*

5

60

$\cancel{60} \cancel{0}$ (10 Days facit.

$\cancel{6} \cancel{0}$

If 5 Days — 12 Men — 10 Days ? *A. 6 M.*

12

60

$\cancel{60} \cancel{0}$ (6 Men. facit.

$\cancel{6} \cancel{0}$

If

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If 10 Days—6 Men—5 Days? *A.* 12 *D.*

$$\frac{60}{6}$$

X
60 (12 Men *facit*)

If 2 *lb* cost 9 *d.* $\frac{3}{4}$, what cost 2 *C.* $\frac{1}{2}$? *A.* 5460

$$\frac{4}{39 \text{ grs.}}$$

$$\frac{4}{10}$$

$$\frac{28}{28}$$

$$\begin{array}{r} \text{X} \\ 10820 \text{ (5460 grs. facit)} \\ 2222 \end{array}$$

$$\frac{20}{80}$$

$$\frac{280 \text{ lb.}}{39}$$

$$\frac{2520}{840}$$

$$\frac{10920}{10920}$$

If 280 *lb*—5460 *grs.*—2 *lb*? *A.* 39 *grs.*

$$\frac{2}{10920}$$

$$\begin{array}{r} \text{X} \\ 10820 \text{ (39 grs. facit)} \\ 2880 \end{array}$$

If 5460 *grs.*—280 *lb*.—39 *grs*? *A.* 2 *lb*

$$\begin{array}{r} \text{X} \\ 10820 \text{ (2 lb. facit)} \\ 360 \end{array}$$

$$\frac{3120}{78}$$

$$\frac{10920}{10920}$$

;

W

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If 39 Qrs. — 2 lb. — 5460 Qrs. ? A. 280 lb.

$$\begin{array}{r} 3'x \\ 10920 \\ x\cancel{0}x2\cancel{0} (280 \text{ lb. } \text{facit.}) \\ 3'x\cancel{x}x \\ 3'3 \end{array}$$

If I spend 476 l. 11 s. 10 d a Year, I demand how much that is one Day with another?

Days. l. s. d. Day.
If 365 — 476 — 11 — 10 — 1 A. 313 d. 361

$$\begin{array}{r} \text{---} \\ 9531 \\ 12 \\ \text{---} \\ 19062 \\ 9532 \\ \text{---} \\ 114382d. \end{array}$$

$$\begin{array}{r} (1 \\ x2 (3 \\ 483 (7 \\ x4832 (313d. \\ 36888 \\ 366 \\ 3 \end{array}$$

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If 1 day — 313 d. — 365 d. *Ans.* 114382

313

1095

3657

10953

1

114382 d.

If 313 d. — 1 d. — 114382 d. *Ans.* 365 Days.

17 (3

2040

114382 (365 days

31333

313

3

days

If 114382 d. — 365 — 313 $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ *Ans.* 1 Day

313

365

1565

18787

9393

1

114382

114382 (1 d.
114382

At 15 d. $\frac{1}{4}$ per lb. how many C. weight for 11 l.
115. 11 d? *Ans.* 1. 2 qrs. 14 lb. $\frac{1}{2}$ Hu.

facit 1 C. $\frac{1}{4}$ lb. $\frac{1}{4}$

If 9 Ells $\frac{1}{2}$ cost 27 s. 5 d. what cost 80 pieces each

each 25 yards, and $\frac{1}{4}$, and 12 pieces, each 19 Ells $\frac{1}{4}$? *Answer.* 275 l. 16 s. 18 d. $\frac{1}{2}$.

If 100 lb . of Cloves cost 88 l. 11 s. 10 d. and 1 C. weight of Mace 99 l. 10 s. 03 d. what cost 3 $\overline{3}$ one with another? *Answer.* 3 s. 4 d. *first*

If 1 pair of Stockings cost 10 groats, how many dozen pair shall I have for 100 marks? *Answer* 33 Dozen and 4 pair.

If 7 lb . $\frac{1}{2}$ of Currants cost 2 s. 7 d. what cost 3 Butts, each 15 C. $\frac{1}{2}$, 14 lb grose, tare 39 lb . per Butt? *Answer.* 88 l. 8 s. 0 d. $\frac{2}{3}$

If 5 Ells $\frac{3}{4}$ of Cambrick cost 21 s. 8 d. what cost 120 pieces, viz.

		Ells. qrs. na.	
Number	A.	20 qt.	372—2—1
	B.	50 qt.	401—3—1
	C.	40 qt.	341—1—3
			1015—2—1

facit 196 l. 8. s 9 d. 3 qrs. $\frac{7}{8}$.

Sold 5 Bags of pepper, each, viz. tare 43 lb per Bag, and tret 4 lb per 104 lb . at 15 d. $\frac{1}{4}$ per lb neat; what comes it to neat?

Alfo

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Also I demand how many Dollers of 4 s. 8 d. a piece, will pay for the next weight?

C.		grs.	
Gqt.	3	—	2
Hqt.	4	—	1
L qt	5	—	3
Mqt.	2	—	1
Oqt.	3	—	3

facit. 515 Doll, $\frac{17}{2}$ or $11\frac{1}{2}$

Sold 10 Packs of Cloth, each Pack qt. 10 Cloths, and each Cloth 39 yards, at 11 s. 11 d. per yard: I demand how much it comes to in all, facit 2323 l. 15 s. 0 d.

C. grs. lb Bought of several persons 433—3—17 of Currants at 4 d. per lb. to whom I have sold 512 C. 3 grs. 7 lb of Sugar at 2 d. $\frac{3}{4}$ per lb. Now I would know what remains for me to pay, they having taken the Sugars in part of payment.

Currant—809 l. 19 s. 00
Sugar—667 l. 10 s. 10 $\frac{1}{4}$

facit Rem. to pay 142 l. 17 s. 01 $\frac{1}{4}$
A Merchant died being indebted to several Creditors, (viz.) to A 40 l. to B. 56 l. to C. 80 l. Now he being dead, his Estate was worth but 30 l. I demand what each man must have?

l.		l.	
A.	6	17	6
B.	9	17	6
C.	13	17	6
Ans <u>u.</u>		C. 13	

facit 30 l.

Bought

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Bought 100 pieces of Cloth for 411 *l.* 11 *s.* 11 *d.* what containeth the Gloth, the yard being valued at 7 *s.* 8 *d.* ?

facit 107 $\frac{2}{3}$ yards $\frac{5}{8}$ $\frac{2}{3}$

If 1 pound of Virginia Tobacco, cost 10 *d.* $\frac{1}{2}$, what cost 3 Hogfheads, weight 17 C. $\frac{1}{4}$ 12 *lb.* gross, tare 37 *lb.* per Hogfhead, and 4 *lb.* P. 104 *trwt* ?

Also I demand how many Duckets of 3 *s.* 9 *d.* $\frac{1}{4}$ will pay for the neat weight ?

A Merchant hath owing 357 *l.* 9 *s.* and his Debtor doth agree with him to pay him for every pound 13 *s.* 5 *d.* I demand what must he pay ?

A man died having three Sons and two Daughters, he gave to the eldest Son 2000 *l.* to the second 1900 *l.* to the thid 1000 *l.* to the Eldest Daughter 700 *l.* to the Second 500. Now he being dead, his Estate was worth but 2020 *l.* I demand what each Child must have ?

<i>l.</i>	<i>l.</i>	<i>l.</i>
If 6100	2020	

Eldest Son Second Son Third Son Eldest Daughter Second Daughter	{	{	2000	{	662 $\frac{1}{4}$
			1900		629 $\frac{1}{4}$
			1000		331 $\frac{1}{2}$
			700 <i>l.</i>		231 $\frac{1}{4}$
			500		165 $\frac{1}{8}$

facit 2020,

If I buy a piece of Cloth for 84 *l.* 11 *s.* and I sell the Ell *Eng.* for 7 *s.* 8 *d.* I demand how many Yards were contained in the said piece?

facit 275 yards $\frac{1}{2}$ and $\frac{2}{3}$ of a *qr.*

Sold 4 parcels of Sugar containing as followeth

	C. <i>qrs.</i>	<i>lb.</i>	<i>lb.</i>
The first containing	86—2—21	tare	84
The second containing	76—1—12	tare	56
The third containing	98—3—11	tare	92
The fourth containing	75—1—17	tare	85

At 35 *s.* per C. neat, *facit* 585 *l.* 6 *s.* $\frac{2}{3}$ or 3 *d.*

If 50 C. 3 *qrs.* 15 *lb.* of Sugar cost 21 *l.* 19 *s.* 11 *d.* how many Chests of 86 C. $\frac{1}{2}$ shall I have for 1000 Marks, and 486 *l.*?

facit 30 Chests and $\frac{2}{3}$ of a Chest.

If 5 penny weight of Silver cost 7 *d.* $\frac{2}{3}$, what cost 3 Ingots, each 11 *lb.* $\frac{1}{2}$?

facit 50 *l.* 0 *s.* 6 *d.*

If a Gent. hath 960 *l.* 12 *s.* per annum, how much may he spend one day with another, to last up 100 Marks at the years end to purchase withall

facit 146 groats $\frac{1}{3}$ of a *d.*

A Merchant bought 376 Cloths, at 11 *l.* 11 *s.* 1 *d.* per Cloth, which he shipped for Spain, to have returns from thence, the one half in Wine, at 28 per Tun, and the other half in Sugar, at 27

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per C. weight, I demand how much of each must be returned for the said Cloaths?

$$\text{Answer } \left\{ \begin{array}{l} 77 \text{ Tuns } \frac{27\frac{1}{2}}{16} \text{ of Wine.} \\ 1609 \text{ C. } 2 \text{ Hb } \frac{1}{2} \text{ of Sugar.} \end{array} \right.$$

There are 101 Pipes of Oil, that contain 12307 gallons; I would know how much 59 Pipes and $\frac{1}{2}$ will contain; and what it will amount to at 36*l* per Tun, the Tun being 236 gallons.

$$\text{facit } 1105 \text{ l. } 18 \text{ s. } 7 \text{ d. } \frac{17}{2}$$

A Merchant bought 9870 C. $\frac{1}{2}$ of Lead, which cost 7*l.* 8 *s.* 5*d.* per Fether, (for 19 C. $\frac{1}{2}$); the Charges upon the same amounts to 125 *l.* 12 *s.* which he ventures for *France*, to receive from thence French Wine at 13*l.* 10 *s.* per Hoghead: I demand how many Hogheads he must receive for content?

$$\text{facit } 287 \text{ Hogheads } \frac{176}{24}$$

A Grocer delivered 7657 *lb.* of Tobacco in the Roll to be cut and dried and when it came home it held out but 5839 *lb.* I demand what is lost in the pound; and also supposing it cost in the Roll 8 *d.* $\frac{1}{2}$ per *lb.* and the cutting 1 *d.* $\frac{1}{4}$ per pound, I demand what it now stands him in?

$$\begin{array}{l} 1 \text{ l. } \text{---} \text{---} \text{---} 9 \text{ d. } \frac{3}{4} \text{---} \text{---} 7657 \text{ l.} \\ \text{It stands him in } 311 \text{ l. } 1 \text{ s. } 3 \text{ d. } \frac{3}{4} \\ 7657 \text{ l. } \text{---} \text{---} 1818 \text{ l. } \text{---} \text{---} 1 \text{ l.} \end{array}$$

$$\text{facit } 3 \text{ oz. } \frac{611}{837} \text{ lost per pound.}$$

F

C H A P.

CH A P. XV.

The Rule of Three in Fractions.

AS in the Rule of Three in whole Numbers, I laid down certain Principles both for the better discovering, and more easy working thereof : So in this of Fractions, I shall endeavour to make all things as plain and familiar as may be.

And first, because many Questions seem very ambiguous, whether they belong to the Rule of Three direct, or indirect.

That you may be rightly informed concerning them, cast your Eye upon the third Number in the Question, and see whether it be greater or lesser than the first Number.

But if you cannot easily apprehend which is the greater or lesser, then work according to the second Section in pag. 80.

What questions belong to the Rule of Three direct.

If the third number be greater than the first, and the Answer required be greater than the second, it is upon the Rule of Three direct.

And likewise if the third number be less than the first, and the Answer required be less than the second, it belongs to the same Rule.

What questions belong to the Rule of Three indirect.

But if the third Number be less than the first, and the Answer required be greater than the second, it is pertaining to the indirect Rule.

And if the third Number be greater than the first, and the Answer required less than the second, it is according to the same Rule.

Having

Having thus found out to what Rule it belongs, first consider diligently, *viz.* whether the first and third Numbers be both of one Denomination, if not, they must be reduced into the least of these Denominations.

2. That your second being a compound Fraction, must be reduced into the lowest, or least name mentioned.

The operation of the Rule of Three direct.

Multiply the Denominator of the first Fraction into the Numerator of the second and third, and the Total thereof shall be the Dividend.

Multiply also the Numerator of the first number by the Denominator of the second, and that Product by the Denominator of the third, and the total shall be the Divisor.

The operation of the Rule of Three indirect.

But when the questions belong to the indirect Rule multiply the Numerator of the first and second together; and the whole thereof by the Denominator of the third; and the Product shall be Dividend.

Multiply also the Denominators of the first and second together; and the total thereof by the Numerator of the third, and the Product that ariseth therefrom shall be the Divisor.

As 1. Note, As in Whole Numbers, so also in Fractions, the 3^d. Term, in all Analogies, must be of the same Name of the 1st, And consequently the 4th Term or Answer Sought must be of the same Name of the Second.

Example.

If $\frac{2}{3}$ of an Ell cost $\frac{2}{3}$ of a l. what cost $\frac{4}{5}$?

$$\begin{array}{r} \frac{2}{3} \\ \frac{4}{5} \end{array} \text{ Dividend} \qquad \frac{2}{3} \text{ Divisor.}$$

$$\frac{1}{3} \text{ l. } 10 \text{ (} 1 \frac{1}{3} \text{) facit.}$$

$$\frac{4}{5} \text{ Ell} \text{ --- } 1 \text{ l. } \frac{1}{3} \text{ --- } \frac{2}{3} \text{ Ell?}$$

$$\frac{\frac{4}{5}}{\frac{2}{3}} \text{ Dividend.}$$

$$\frac{\frac{1}{3}}{\frac{2}{3}} \text{ Divisor.}$$

$$\frac{40}{60} | \frac{2}{3} \text{ l. facit.}$$

$$\begin{array}{r} \text{If } \frac{2}{3} \text{ l. --- } \frac{2}{3} \text{ Ell --- } 1 \text{ l. } \frac{4}{5} ? \\ \text{If } \frac{2}{6} \qquad \qquad \frac{2}{10} \qquad \qquad \frac{1}{3} \\ \frac{2}{4} \qquad \qquad \frac{2}{10} \end{array}$$

$$\frac{2}{60} | \frac{1}{15} | \frac{4}{5} \text{ Ell facit.}$$

$$\begin{array}{r} 1 \text{ l. } \frac{1}{3} \text{ --- } \frac{4}{5} \text{ Ell --- } \frac{2}{3} \text{ l. ?} \\ \frac{1}{10} \frac{4}{5} \qquad \frac{2}{10} \\ \frac{1}{10} \frac{2}{5} \end{array}$$

$$\frac{2}{60} | \frac{1}{30} | \frac{4}{5} \text{ Ell facit.}$$

For proof of these and the following Questions, the same method is to observed, as in the Rule of Three in whole Numbers.

If

If $\frac{1}{2}$ lb. cost $\frac{1}{4}$ of a Shil. what cost $\frac{1}{4}$ of a lb.

$$\begin{array}{r} \frac{1}{2} \text{ lb.} \\ \times \frac{1}{4} \\ \hline \frac{1}{8} \end{array}$$

$$\begin{array}{r} 10 \\ \times 8 \\ \hline 80 \end{array}$$

facit.

If $\frac{1}{2}$ lb. cost 1 s. $\frac{1}{8}$, what cost $\frac{1}{4}$ lb. ? facit $\frac{1}{4}$ of a s.

$$\frac{1}{2} \text{ lb.}$$

$$\frac{1}{8}$$

$$\begin{array}{r} 2 \\ \times 48 \\ \hline 96 \end{array}$$

If $\frac{1}{4}$ of a Shil. buy $\frac{1}{2}$ lb. what will 1 s. $\frac{1}{8}$?

$$\frac{1}{4}$$

$$\frac{1}{2}$$

$$\begin{array}{r} 36 \\ \times 12 \\ \hline 432 \end{array}$$

If 1 s. $\frac{1}{4}$ — $\frac{1}{4}$ lb. — $\frac{1}{4}$ s ?

$$\frac{1}{4}$$

$$\frac{1}{4}$$

$$\begin{array}{r} 72 \\ \times 2 \\ \hline 144 \end{array}$$

To prevent discouragement to Young Scholars in the Questions of this Rule, which indeed are somewhat intricate, I advise them to turn to the Rule of Three in whole Numbers, and exercise themselves well therein, and especially in such Questions as are most plain and easy, till they thoroughly understand the nature of the Rule; by means whereof all other questions will be more easily wrought, be they never so difficult.

If 6 Yards and $\frac{1}{2}$ cost 8 Shillings, what cost 9 Yards and $\frac{1}{2}$?

$$6 \frac{1}{2} : 8 :: 9 \frac{1}{2} :$$

$$\text{facit } 11 \text{ s. } \frac{1}{2}$$

If 3 . . . If

If 1 Dollar be 56 Pence $\frac{2}{3}$, what 500 Dollars?
 $\frac{1}{2} : 4\frac{1}{2} :: 500 : facit 28500 d. or 117 l. 18 s. \frac{3}{4}$

1—56 d. $\frac{2}{3}$ —500 *facit* 117 l. 18 s. $\frac{3}{4}$.

If 2 Ounces and $\frac{1}{2}$ cost 16 s. 5 d. what cost $\frac{1}{3}$?
 $2\frac{1}{2} : 16 \frac{5}{8} :: \frac{1}{3} : facit 59 d. 1\frac{1}{2}$

When the Bushel of Wheat is sold for 6 s. $\frac{2}{3}$, the Half-penny white Loaf shall weigh 5 $\frac{1}{3}$ $\frac{1}{2}$: 1 demand how much it ought to weigh when the Bushel is sold for 7 s. $\frac{1}{2}$?

6 s. $\frac{2}{3}$ ————— 5 oz. $\frac{1}{3}$ ————— 7 s. $\frac{1}{2}$.
facit 5 oz. $\frac{7}{8}$.

If 1 Yard cost 9 s. what cost 4 Yards $\frac{1}{2}$?
 $\frac{1}{2} : \frac{9}{2} :: 4 \frac{1}{2} : facit 43 s. \frac{1}{2}$

If 3 Ells $\frac{1}{4}$ cost 15 d. $\frac{1}{4}$, what cost 6 Ells $\frac{1}{4}$?
 $3 \frac{3}{4} : 15 \frac{1}{4} :: 6 \frac{3}{4} : facit 8 s. 7 d. \frac{1}{2}$

If $\frac{3}{4}$ of a Yard cost $\frac{4}{9}$ of a l. what cost $\frac{1}{2}$ of a Yard?
 $\frac{3}{4} : \frac{4}{9} :: \frac{1}{2} : facit 10 s. \frac{1}{2}$

If 3 Yards and $\frac{1}{4}$ cost 4 l. 14 s. $\frac{2}{3}$, what cost $\frac{1}{2}$ of an Ell Flemish?
 $3 \frac{1}{4} : 4 l. 14 s. \frac{2}{3} :: \frac{1}{2} : facit 10 s. \frac{1}{2}$

$6\frac{2}{3} : 4\frac{2}{3} :: 7\frac{2}{3} : facit 17 s. \frac{11}{12}$

If 1 lb. cost 6 d. $\frac{1}{2}$, what cost 4 l. $\frac{1}{2}$?
 $1 : 6 \frac{1}{2} :: 4 l. : facit 30 d. 1\frac{1}{2}$

If 1 Ell $\frac{1}{4}$ cost 9 s. 2, what cost 1 Yard?
 $1 : 9 \frac{1}{4} :: 1 : facit 4 s. 5 \frac{1}{2}$

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I lent my Friend $\frac{6}{10}$ of a French Crown for three Weeks, that he should do as much for me another time : but when I came to borrow of him, he could lend me but $\frac{1}{5}$ of a Crown : I demand how long time I must keep his Money to requite my former kindness ?

$$\text{If } \frac{6}{10} : \frac{1}{5} :: \frac{1}{x} :$$

$$\text{facit } 4 \text{ Weeks } \frac{2}{3}.$$

2. Note, When any of the three Terms given, in the Analogy, happens to be a Mixt Number, it must first be Reduced into an Improper Fraction, before Multiplication, and Division, can be Performed as above.

If 1 Pistollet be 5 r^o, what shall 430 be ? thus,

$$\frac{1}{1} \text{ --- } 5 \text{ s. } \frac{7}{6} \text{ --- } 430 \text{ facit } 126 \text{ l. } 17 \text{ s.}$$

If 13 lb. cost me 3 l. how many lb. shall I have for 97 d.

$$\frac{1}{1} : \frac{13}{1} :: \frac{97}{x} :$$

$$\text{facit } 1 \text{ lb. } \frac{4}{25}$$

If $\frac{3}{4}$ lb. cost 9 d. $\frac{2}{3}$, what cost 6 lb. 9 oz. $\frac{1}{4}$?

$$\frac{3}{4} : 9 \frac{2}{3} :: 6 \frac{1}{4} : x$$

$$\text{facit } 342 \text{ d. } \frac{1}{7}$$

If 5 Yards of Velvet cost 4 l. 3 d. $\frac{1}{4}$, what cost

4 Yards $\frac{2}{3}$? $x : 4 \text{ l. } \frac{3}{4} :: 4 \frac{2}{3}$
facit 3 l. 17 s. 11 d. 2 qrs. $\frac{3}{5}$.

If 1 C. $\frac{1}{2}$ cost 4 l. 12 s. what cost $\frac{1}{8}$ C ?

$$\frac{1}{2} \text{ --- } 92 \text{ s. --- } \frac{1}{8}$$

$$\text{facit } 33 \text{ s. } \frac{1}{4}.$$

If 1 C. cost 11 l. 17 s. $\frac{8}{9}$, what cost 4 oz. $\frac{1}{4}$?

$$\text{facit } 5 \text{ s. } 2 \text{ d. } 3 \text{ q. } 7 \text{ s. } \frac{2}{3} \text{ oz. --- } \frac{1}{4} \text{ --- } 17 \text{ oz. } \frac{1}{2}$$

F 4

If

If $\frac{3}{4}$ of an Ell cost 1 l. 2 s. what cost $\frac{1}{8}$?
 $\frac{3}{4} : 1 \frac{2}{20} :: \frac{1}{8} :$ *facit* 32 s. 1 d.

If 10 Ells cost 3 l. $\frac{2}{4}$, what cost 1 Yard ?
 $\frac{3}{2} : 1 \frac{8}{10} 1 \frac{4}{10}$ or 50—18—4
facit 1 l. $\frac{2}{3}$

If $\frac{1}{4}$ C. cost $\frac{1}{1}$ of l. what cost 1 C. $\frac{1}{7}$?
 $\frac{1}{4} \text{ — } \frac{1}{1} \text{ — } \frac{1}{7} \text{ facit. } 4l. \frac{4}{7}.$

If $\frac{1}{1}$ of C. cost $\frac{1}{3}$ l. what will 3 s. $\frac{7}{10}$ buy ?
 $\frac{24}{100} \text{ — } \frac{1}{3} \text{ C. — } \frac{3}{5} \text{ s. facit } 17l. 10 \text{ oz. } \frac{76}{100}.$

If $\frac{3}{4}$ of a Yard of Cloath in length, and 1 Yard $\frac{1}{4}$ broad make a Child's Coat, I demand how much Stuff will make the same Child a Coat, when the Stuff is but $\frac{3}{4}$ of a Yard broad ?

$$\frac{7}{1} \text{ — } \frac{6}{2} \text{ — } \frac{3}{2} \text{ facit } 1 \text{ Yard } 1 \frac{1}{2}.$$

If 8 lb. $\frac{1}{2}$ cost 2 l. 11 s. $\frac{3}{4}$, how many lb. shall I buy for 4 l. $\frac{1}{8}$? If $\frac{20}{100} : \frac{3}{4} :: \frac{2}{6} \frac{2}{10}$
facit. 14 lb. $\frac{44}{96} \frac{3}{8}.$

If $\frac{7}{1}$ of 1 C cost $\frac{1}{1}$ of 2 l. what cost $\frac{1}{4}$ of 2 Pound ? $\frac{24}{7} \text{ lb.} : \frac{1}{1} \text{ lb.} :: \frac{1}{4} \text{ lb.}$
facit. $\frac{10}{36} \frac{1}{100}$ or 3 $\frac{2316}{26800}$

If $\frac{1}{7}$ of an oz. cost $\frac{1}{12}$ of a Penny, how much shall I buy for $\frac{6}{1}$ of 20 s. ?
 $\frac{1}{7} : d. : 7 \text{ oz.} :: \frac{144}{11}.$ *facit.* 309 oz. $\frac{7}{147}.$

If $\frac{1}{3}$ of a Pound cost $\frac{7}{1}$ of a l. how many Pounds shall I have for 2 l. 7 s. 3 d. $\frac{1}{2}$?
 $\frac{7}{1} \text{ l.} : \frac{1}{3} \text{ l.} :: 4368 \frac{6}{8} \text{ facit } 3 \text{ lb. } \frac{27}{27} \frac{60}{60}.$

How

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How many Yards are bought for 142 l. 11 s. 2 d. when the $\frac{1}{2}$ of $\frac{3}{7}$ of a Yard cost 6 s. $\frac{2}{3}$?

6 s. $\frac{2}{3}$: $\frac{3}{7}$ Yd. :: 2851 s. $\frac{1}{2}$: facit. 161 Yds. $\frac{284}{3}$.

If 1. C $\frac{3}{4}$ 12 lb. $\frac{1}{3}$ cost 2 l. $\frac{5}{6}$, what cost $\frac{2}{3}$ of an oz. ? $6\frac{2}{3}$ lb. : $\frac{1}{3}$: : $\frac{1}{7}\frac{1}{4}$ lb. facit. $\frac{1}{2}\frac{1}{6}\frac{1}{6}\frac{1}{6}$.

If 26 lb. at Antwerp be 27 lb. $\frac{1}{8}$ at London, how many Pounds at Antwerp are 56 lb. at London ? $\frac{221}{8}$ l. : $\frac{21}{8}$: : $\frac{16}{1}$ l. : facit 52 A. $\frac{1}{2}\frac{1}{2}$.

If 8 Ells at Antwerp be 5 Ells $\frac{1}{2}$ at London, how many Ells at Antwerp are 150 Ells $\frac{1}{1}$? $\frac{24}{7}$ Ells. l. : $\frac{8}{7}$ Ells. A. : : $\frac{16}{1}\frac{7}{1}$? facit 231 Ells. $\frac{1}{1}\frac{1}{4}\frac{1}{2}$.

If $3\frac{1}{2}$ times $3\frac{1}{2}$ lb. cost $1\frac{1}{2}$ times $1\frac{1}{2}$ l. what shall amount unto $\frac{1}{2}$ times $\frac{1}{4}$ of the $\frac{1}{3}$ of 12 l. $\frac{1}{2}$? $4\frac{9}{4}$ — $\frac{2}{4}$ — $\frac{42}{8}$ facit $\frac{1}{7}\frac{1}{2}\frac{1}{4}$ of a l.

If $\frac{1}{2}$ less $\frac{1}{7}$ lb. cost $2\frac{1}{4}$ l. and the $\frac{1}{2}$ of $\frac{7}{8}$ lb. what shall 10 lb. less $\frac{1}{7}$ and $\frac{1}{4}$ of $3\frac{1}{2}$ lb. amount unto ?

$\frac{1}{6}$ — $1\frac{1}{2}$ — $3\frac{1}{2}$ facit 135—17—0—3

If a French Crown be worth $52\frac{1}{2}$ d. $5\frac{1}{2}$ Sterling how many must be received for 100 l. $\frac{1}{2}$ Sterling. ?

Crown.
 $11\frac{1}{2}$ d. — $\frac{1}{2}$ — $72\frac{1}{2}$
 $32\frac{1}{2}$ d. — $\frac{1}{2}$ — $72\frac{1}{2}$
facit 460 Cr. $\frac{4}{5}$.

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3. Note, If any one of the three Terms given, happen to be those Fractions, which are Term'd *Fractions of Fractions*, or Compound Fractions, with the Particle (of) between them. Let them be first Reduced into a single Fraction of one Denomination according to Sect 2. in Reduction of Fractions; And then proceed according to the Rule, as above.

When $\frac{1}{2}$ of 5 Ells less $\frac{1}{2}$ of an Ell cost $\frac{1}{2}$ of 9 $\frac{1}{2}$ l. less $\frac{1}{2}$ of 2 l. what then shall $\frac{1}{2}$ of 6 Ell less $\frac{1}{2}$ of an Ell?

If $\frac{1}{2}$ of 20 *lb.* cost 36 l. less $\frac{1}{4}$ of 30 l. I demand how much $\frac{1}{2}$ of 40 *lb.* and $\frac{1}{2}$ $\frac{2}{3}$ $\frac{4}{4}$, will amount unto?

$$\frac{40}{3} : 27 : 2 \frac{1 \frac{1}{2}}{2} \text{ facit } 35 \frac{2 \frac{2}{3}}{3} \frac{1}{2} \text{ l.}$$

If an Ingot of Silver, whose weight is 60 *lb.* be better 16 *lb.*, I demand the Standard weight of the Ingot, also the Betterness; Note, That the Standard is 11 *lb.* 2 *dwt.* First, subtract the Standard-weight from the Betterness, then it follows:

$$\frac{11}{2} \frac{1}{10} : 49 \frac{1}{2} : 580 \frac{7}{2}$$

lb.

$$358 \frac{2 \frac{2}{3}}{3} \frac{1}{2} \text{ Betterness.}$$

$$728 \frac{2 \frac{1}{2}}{3} \frac{1}{2} \text{ Weight of the Ingot}$$

$$1086 \frac{1}{2} \frac{1 \frac{1}{2}}{3} \frac{1}{4} \text{ Standard wt. in oz.}$$

$$90 \text{ lb.} : 6 \text{ oz.} : 13 \text{ dwt. } 2 \frac{1}{2} \frac{2}{3} \text{ facit}$$

An Ingot of Silver, weight 47 $\frac{1}{2}$ *lb.* and is worse 14 $\frac{1}{2}$ oz. I demand the Worthens of the Ingot, and also the Standard-weight

$$\frac{11}{2} \frac{1}{10} : 49 \frac{1}{2} : 57 \frac{1}{2}$$

$$\text{lb. } 13 - 02 \text{ oz.} - 6 \text{ dwt. } \frac{1}{11} \frac{1}{4} \text{ worthens fa.}$$

$$\text{lb. } 34 - 06 \text{ oz.} - 13 \text{ dwt. } \frac{1}{11} \frac{2}{2} \text{ stand. fa.}$$

C H A P.

When the price is an even part of a Shilling consider what part of a Shilling it is; which being found, divide the Sum propounded by it, and the Quotient will be Shillings: As in these six Examples following will appear.

<i>Ell.</i>	<i>d.</i>		<i>lb.</i>	<i>d.</i>
$\frac{1}{2}$ 18 468	at 6 per Ell.		$\frac{1}{6}$ 3618	at 2 per lb.
$\frac{1}{2}$ 423 4			60 3	
$\frac{2}{3}$ 211-14-0	<i>facit.</i>		30—3	<i>facit.</i>
867 at 4 d. per Ell.		<i>Yards. d.</i>	2760 at 1 $\frac{1}{2}$ per Yard	
28,9		$\frac{1}{8}$ 34,5		
14-9-0	<i>facit.</i>	$\frac{1}{20}$ 17-5	<i>facit.</i>	
lb.		lb.		
276 at 3 d. per lb.		4896 at 1 per lb.		
$\frac{1}{4}$ 69		$\frac{1}{12}$ 40 8		
$\frac{1}{2}$ 69		$\frac{1}{6}$ 20—8	<i>facit.</i>	
3-9	<i>facit.</i>			

Having gone thus far upon those even parts of a Shilling that are most easie, I must intreat the Learner to return back to a farthing, an half-penny, three farthings, &c. the other parts of a Shilling.

II. When the price is Farthings, or Half-pence, bring the given Sum into Pence, and work as before in the last question; but when they are uneven parts, as Penny-farthing, penny-three-farthings, two-pence

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pence-farthing, or the like: Begin first with the even parts of a shilling: As for instance, 6396 Ells at 5 farthings *per* Ell, work first for the penny, as before, then consider, if at the price of a penny they come to so many shillings, then the farthing, must be the fourth part of them, which being taken and added together, your work is done.

Ells.		Ells	
$\frac{1}{4}$	420 at $1\frac{1}{4}$ d. <i>per</i> Ell.	$\frac{1}{2}$	716 at $\frac{1}{2}$ d. <i>per</i> Ell
$\frac{1}{1}$	105	$\frac{1}{12}$	358
	8-9 d. <i>facit.</i>	$\frac{1}{20}$	21 9-10 d.
			1 9-10 <i>facit.</i>

Ells. d.		Ells. d.	
$\frac{1}{2}$	6396 at $\frac{1}{4}$ <i>per</i> Ell.	$\frac{1}{8}$	7225 at $1\frac{1}{4}$ <i>per</i> Ell.
$\frac{1}{2}$	3198	$\frac{1}{6}$	903-1 $\frac{3}{4}$
	266-6 d.		150-6 $\frac{3}{4}$
	133-3	$\frac{1}{20}$	105 3-7 $\frac{3}{4}$
$\frac{1}{20}$	391 9-9		52-13-7 $\frac{3}{4}$ <i>facit.</i>
	19-19-9 <i>facit.</i>		
$\frac{1}{12}$	5712 at 1 d. $\frac{3}{4}$		
$\frac{1}{4}$	476		
	119		
$\frac{1}{10}$	5915		
	29-15 <i>facit.</i>		

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III. When any thing doth remain of any Division, it is of the same Denomination as the Dividend was, as here in the last Example 7225 three half pence being divided by 8, there remains one three half pence.

$\frac{1}{2}$	864 at 2 d. $\frac{2}{3}$	$\frac{1}{4}$	3716 at 3 d. $\frac{4}{5}$
$\frac{6}{4}$	144	$\frac{1}{12}$	929
	36		77—5
$\frac{1}{20}$	1810		5 — 5
	9l.-0s.-0d. <i>facit</i>		50-65 <i>facit</i> .
$\frac{1}{6}$	3714 at 2 d. $\frac{2}{3}$	$\frac{1}{4}$	41712 at 3 d. $\frac{4}{5}$
$\frac{1}{4}$	619	$\frac{1}{6}$	10428
	154-9		1738
$\frac{1}{20}$	7113-9	$\frac{1}{20}$	1216-6
	38-13-9 <i>facit</i> .		608.6-0 <i>facit</i> .
$\frac{1}{6}$	417 at 2 d. $\frac{2}{3}$	$\frac{1}{4}$	817 at 3 d. $\frac{2}{3}$
$\frac{1}{4}$	69—6	$\frac{1}{4}$	204—3 d.
$\frac{1}{2}$	17—4— $\frac{1}{2}$		51—0 $\frac{2}{3}$
	8—8— $\frac{1}{4}$		255-3 $\frac{2}{3}$
$\frac{1}{20}$	915—5— $\frac{2}{3}$	$\frac{1}{20}$	12-115-3 $\frac{2}{3}$ <i>facit</i> .
	15-6 $\frac{2}{3}$ <i>facit</i> .		

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$\frac{1}{6}$	7138 at 4 d. $\frac{1}{4}$	$\frac{1}{3}$	712 at 5 d.
$\frac{1}{8}$	1189 — 8 148 — 8 $\frac{1}{3}$	$\frac{1}{4}$	237 — 4 5 — 4
$\frac{1}{20}$	2528 — 0 $\frac{1}{2}$	$\frac{1}{20}$	296 — 8
	1268 — 0 — 0 $\frac{1}{2}$ facit	$\frac{1}{10}$	1416-8 facit.
$\frac{1}{3}$	5171 at 4 d. $\frac{1}{2}$	$\frac{1}{6}$	3716 at 7 d.
$\frac{1}{8}$	1723 — 8 215 — 1 $\frac{1}{2}$		1858 309 — 8
$\frac{1}{20}$	1938 — 9 $\frac{1}{2}$ $\frac{1}{8}$ facit. 9618 — 1 $\frac{1}{8}$ facit.	$\frac{2}{10}$	2167 8
$\frac{1}{3}$	971 at 4 d. $\frac{2}{4}$	$\frac{1}{3}$	108-7-8 facit.
$\frac{1}{8}$	323 — 8 40 — 5 $\frac{1}{2}$ 20 — 2 $\frac{3}{4}$		8716 at 8 d.
$\frac{1}{20}$	384 — 4 — $\frac{1}{4}$	$\frac{1}{20}$	2905 — 4 2905 — 4
	19-4-4 $\frac{3}{4}$ facit.		5810 — 8
			290-10-8 facit.

Note, *The Reader may here observe, That when the Work is twice Repeated, it Indicates that the given Number or Quantity, is twice Divided by the Aliquot Part or Divisor, and consequently, each Quotient, or particular Number so found, hath always, its proper Aliquot Part or Divisor, plac'd on the Left-Hand, in order to find the next Quotient or Subsequent Number, sought as above.*

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$\frac{1}{2}$	6371 at 9 d.	$\frac{1}{2}$	2716 at 12 d.
$\frac{1}{1}$	3185—6		
	1592—9		
$\frac{1}{20}$	4778—3	$\frac{1}{4}$	135 l. 16 s <i>facit.</i>
	238-18-3 <i>facit.</i>		
$\frac{1}{2}$	846 at 10 d.	$\frac{1}{2}$	362 at 12 d. $\frac{1}{4}$?
$\frac{1}{2}$			
$\frac{1}{2}$	423		188 $\frac{1}{2}$
$\frac{1}{3}$	211—6		940—6
			950—6
			79—2 $\frac{1}{2}$
	70—6		
$\frac{1}{20}$	705—0	$\frac{1}{20}$	3851—1 $\frac{1}{2}$
			192—11—2 $\frac{1}{2}$ <i>facit.</i>
$\frac{1}{1}$	355—0 <i>facit.</i>		
$\frac{1}{20}$	4687 at 11 d.		
$\frac{1}{4}$	2343—6		
	1562—4		
	390—7		
$\frac{1}{2}$	4296—5		
	214-16-5 <i>facit.</i>		

5627 Ells at 13 *d.*, *per* Ell.

IV. As for the 12 *d.* that is done to your hand, there being so many shillings as there are Ells: then for the penny, consider that at 12 *d.* *per* Ell, it comes to so much, and the odd penny take $1\frac{1}{2}$, of the giving Sum, which will make likewise shillings. And thus you may do touching any of the following Questions, by taking the even or uneven parts, as you have learned before.

$11\frac{3}{4}$	2634 at 13 <i>d.</i>	$\frac{1}{4}$	7684 at 15 <i>d.</i>
	223 — 7		7684
	2907 — 8		2921
$1\frac{1}{2}$	l. s. d	$1\frac{1}{2}$	9605
	145-7-7 <i>facit.</i>		
$\frac{1}{6}$	8642 at 14 <i>d.</i>		4805 <i>facit.</i>
	8642		3716 at 16 <i>d.</i>
	1440 — 4	$\frac{1}{3}$	3716
			1238 — 8 <i>d.</i>
$1\frac{1}{20}$	1008 2-4	$1\frac{1}{20}$	4954 — 8
	504-2-4 <i>facit.</i>		247-14-8 <i>facit.</i>

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$\frac{1}{2}$	3141	at 17 d.	$\frac{1}{2}$	417	at 21 d.
$\frac{1}{3}$	3141		$\frac{1}{2}$	3415	
$\frac{1}{4}$	1047		$\frac{1}{2}$	1-14-9	
	261-3			l. 36-09-9 <i>facit.</i>	
$\frac{1}{5}$	444, 9-3		$\frac{1}{2}$	102, 1	at 22 d.
$\frac{1}{6}$	222 - 9	113 <i>facit.</i>	$\frac{1}{2}$	l. 8-10-2	
	1236	at 18 d.		53-11-10 <i>facit.</i>	
$\frac{1}{7}$	1236-5		$\frac{1}{2}$	31, 7	at 23 d.
$\frac{1}{8}$	618		$\frac{1}{2}$	29-8-4	
$\frac{1}{9}$	185, 4		$\frac{1}{2}$	3-6-0	
	92-14 <i>facit.</i>		$\frac{1}{2}$	0-13-2	
$\frac{1}{10}$	26812	at 19 d.	$\frac{1}{2}$	30-7-7 <i>facit.</i>	
$\frac{1}{11}$	13406		$\frac{1}{2}$	171, 2	at 2 s.
$\frac{1}{12}$	2234-4			l. 171-4 <i>facit.</i>	
$\frac{1}{13}$	42450 : 4				
$\frac{1}{14}$	2122-12-4 <i>facit.</i>				
$\frac{1}{15}$	1213	at 20 d.			
$\frac{1}{16}$	101-1-8 <i>facit.</i>				

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$\frac{1}{2} +$	412 at 2 s. 3 d.	$\frac{1}{8}$	1410 at 2 s. 6 d.
+ 2			
824			61176-5-0 <i>facit.</i>
103			
$\frac{1}{20}$	927 s. 4 l. s 07-00 <i>facit.</i>	$\frac{1}{8}$	712 at 2 s. 7 d.
$\frac{1}{3}$	106 at 2 s. 4 d.	$\frac{1}{8}$	89-0
			2-19-4
	212	$\frac{1}{10}$	91119 : 4 <i>facit.</i>
	35-4		100 at 2 s. 8 d.
$\frac{1}{2}$	24, 7-4 or 12-7-4 <i>facit.</i>	$\frac{1}{3}$	10 : 0
			1 : 6 : 8
	171 at 2 s. 5 d.		13 : 6 : 8 <i>facit.</i>
$\frac{1}{6}$	17-02	$\frac{1}{6}$	
$\frac{1}{4}$	2-17-00		
	0-14-03		
	20-13-03 <i>facit.</i>		
$\frac{1}{8}$	6101 at 2 s, 9 d.	$\frac{1}{8}$	6109 at 2 s 11 d.
$\frac{1}{10}$	762 : 12 6	$\frac{1}{6}$	763-12-6
	76 : 5 : 3		127-5-5
	838 : 19 : <i>facit.</i>		890 : 17 : 11 <i>facit.</i>

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$\frac{1}{10}$	1006 at 2s. 10d.
$\frac{1}{3}$	100 : 12 : 0
$\frac{1}{1} +$	33 : 10 : 8
	8 : 07 : 8
	142 : 10 : 4 <i>facit.</i>

4672 Ells and $\frac{1}{2}$ at 4 d. and 4 d. per Ell.
Ans w. 1012 : 7-6 d.

Questions of this nature that do consist of several Denominations, as, $\frac{1}{27}$, $\frac{1}{77}$, $\frac{1}{77}$, &c. are wrought as before, only for the half Ell, take half of the given price of an Ell, &c. for a quarter, take a quarter of the price, &c. and add it to the former Sum.

Example.

$\frac{1}{3}$	<i>Ells.</i>		$\frac{1}{2}$	<i>C.</i>	<i>s. d</i>
	4672 $\frac{1}{2}$ at 4s. 4d			17 4 at 17-7 per C.	
	+ 4 2 2			17	
	18688			119 4-4 $\frac{3}{4}$.	
	1557-4 d.			17	
	2-2			(-8-6	
				(-1-5	
$\frac{1}{20}$	2024 7-6		$\frac{1}{2}$	14-4 $\frac{3}{4}$	
			$\frac{1}{6}$		
	1012-7=6 <i>facit.</i>		$\frac{1}{20}$	30 3-5 $\frac{3}{4}$	
				15-3-4 $\frac{3}{4}$ <i>facit.</i>	

If the price required be concerning pounds neat, you must reduce the hundreds gross, and subtract the pounds tare from them, and the remains will be pounds neat.

32 C. gross, tare 172 lb. at 7 d. per lb. neat.	36 C. gross, tare 94 lb. at 14 d. per lb. neat.
32 C.	36 C.
112	112
64	72
32	36
32	36
3584 lb. gross.— 172 lb. tare.	4032 lb. gross. 94 lb. tare
3412 lb. neat. d.	3938 lb. neat d.
3412 at 7 d. per lb	3338 at 14 per lb.
1706	3938
284—4 d.	656—4 d.
1990—4 d.	4594—4 d.
99-10-4 facit.	229-14-4 facit.

Note, That in all Examples of Practice, the Quotient or Subsequent Number, immediately follows that which is Divided by the Aliquot Part or Divisor.

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VIII. Again, observe whether the pounds tare be absolutely so much as in the last Example, or whether it be so much *per Bag, per C. or Barrel, &c.* If it be any of these, multiply the tare given by the *C. Bag, or Barrel*, and the Product will be pounds tare, which subtract from the pounds gross, and the remains are pounds neat.

Example.

56 C. gross, Tare	12 C. gross, Tare
17 lb <i>per C.</i> at 9 <i>d.</i>	13 lb. <i>per C.</i> at 18 <i>d.</i>
17 lb. neat.	<i>per lb.</i> neat.
56	12
112	112
112	1344
56	13
392	12
56	36
952	
6272 lb gross.	134 lb. gross. 156 tare
952 lb. tare.	
5320 lb. neat:	1344 lb. gross.
5320 lb. at 9 <i>per lb.</i> <i>d.</i>	156 lb. tare.
2660	1188 lb. neat.
1330	1188 at 18 <i>per lb</i> <i>d.</i>
399.0	1188
199-10 <i>facit</i>	504
	1792
	3912.0 <i>facit.</i>

IX.

IX. Observe whether the given price required be at so much *per C.* if so, then bring your pounds Tare into C. and subtract them from the C. gross.

Example.

17 C. gross, Tare	20 C. gross, Tare
11 lb. <i>per C.</i> at	13 lb. <i>per C.</i> at
15 s. <i>per C.</i> neat.	12 s. <i>per C.</i> neat.
17	200
11	13
17	60
7 (5 C. gr. lb.	20
187 (1.2-10 ta.	20
XX2	20
C. gr. lb.	(3) 6 C. gr. lb.
17-0-0 gross.	280 (2-1-8 ta.
1-2-19 tare.	XX2
15-1-9 neat.	C. gr. lb.
C. gr. lb.	202-0-0 gross.
15-1-9 at 15 s. p. C.	2-1-8 tare
15 +	17-2-20 at 12 s.
75	(per C
15	
225	
3-9	1 C. 34
1-2-1	lb. 17
1	204
22 9-11 4	6
11 9 11-1/2 facit.	21-2-2
	10-2-1 d. 1/2 facit.

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X. I think those former Rules well observed, to be sufficient for your Instruction touching Tare, only if the gross h^udr^s have several speices, as $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ odd pounds, or the like, then consider, if one hundred give so much Tare, then a quarter of a C. will give a quarter so much; and if one quarter give so much, 14 pound will give half so much; and if 14 pound give so much, then 7 pound will give half as much, &c.

Example.

13 C. $\frac{1}{2}$ gross	96 C. $\frac{1}{2}$ 14 pound
Tare 12 pound	gross, Tare 13 lb
per C. at 2s. 3d.	per C. at 3s. 6d.
per pound Neat	per pound Neat

What Tret is.

XI. Having thus shewed you the way of finding out the Tare, I come in the next place to shew you how to find out the Tret, which is ascertain allowance of 4 lb per 104 lb upon many sorts of Commodities.

Example.

- 39 C. Gross Tare 15 lb. per cent. and 4 lb. per 104 lb. Tret, at 4s. 6d. per lb. Neat.
1. Bring the C. gross into pounds gross.
 2. Multiply the lb. tare by the C gross, and the Product is the pound tare.
 3. Subtract the lb tare from the lb. gross, and the remain is subbl pounds, which pounds divide by 26, because 26 is contained 4 times in 104, and as often

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often as it is contained, so many pounds Tret then are, which subtract from the subtil pounds, and the remain will be neat pounds.

C.

39
112

39
15

78

195
39

39

585 lb. tare.

4368 lb. gross.
585 lb. tare.

XXXX (1 lb.

3783 lb. subtil.
145 lb. tret.

378 (3 (145 tret.
2668 22

3638 lb. neat.

At 4 s. 6 d. per lb. facit 821 l. 1 s.

Other ways there are to find out the Tare, but I conceive these are the most plain for young Learners. However I shall give them one or two Examples of another manner of working, which is both very commendable and speedy.

1. When the Tare is 14 pound *per cent.* take the $\frac{1}{5}$ part of the pounds gross, and the Quotient will be pounds Tare.

2. When the allowance is Tare 16 l. *per cent.* take the $\frac{1}{7}$ part, or divide it by 7, and the Quotient will be pounds Tare.

3. Suppose it were Tare 24 pounds *per cent.* work first for 16 as before, then take the $\frac{1}{2}$ of that which 16 cometh to, for if 16 produce so much, 8 must Produce the $\frac{1}{2}$ of that, which being added will make the pounds Tare for 24 pounds *per cent.*

Again,

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Again, suppose it were at 22 pound *per cent.* you may work first for 16, and then 4 will be the $\frac{1}{4}$ of that Quotient, which being added maketh the total of your pounds Tare for 20 pound *per cent.*

Again, suppose it were for 12 pound *per cent.* Tare, work as before for 16, which Quotient is for 4 too much, therefore take the $\frac{1}{2}$ of that, and subtract from that of 16, and the remains will be pounds Tare, or 12 pound *per cent.*

Again, suppose it were 7 pounds *per Cent.* tare, work for 14, and if 14 comes to so much, then 7 will be $\frac{1}{2}$ of that: and you may with ease work all questions of this kind, by making 14 or 16 your standing Rule, adding and subtracting the part or parts of it more or less, as occasion requires. I might say more as to this, but shall forbear, only I will give you two or three Examples ready cast up, and state a few others to exercise your ingenuity therewith.

48 C. gros. Tare 14 lb Pound *per Cent.* at 10 $d \frac{1}{2}$ *per* Pound neat.

C.
48 4704 lb . at 10. $\frac{1}{2}$ *per* lb .
112

96
48
48

5276 lb . *gross.*
-Sub. $\frac{1}{8}$ 672 lb . *tare.*

Rem. 4704 lb . *neat.*

G 2

56 C.

56 C. $\frac{1}{4}$ gross; Tare 16 Pound <i>per Cent.</i> at 9 <i>d.</i> <i>per</i> Pound neat.		77 C. $\frac{3}{4}$ 11 lb gross. Tare 24 lb <i>per Cent.</i> at 5 <i>d.</i> <i>per</i> lb. neat.	
C.		97-3-11	
56 $\frac{1}{2}$		4	
4		391	
		28	
225		3129	
28		783	
1800		10959 <i>lb.</i> gross.	
450		1565	
		782	
$\frac{1}{7}$			
6300 lb. gross. 900 lb. tare.		2347 lb. tare.	
$\frac{1}{2}$		$\frac{3}{4}$	
5400 lb. neat at 9 <i>d.</i>		8612 lb. neat 5 <i>d</i>	
$\frac{1}{2}$			
2700		2870—8	
1350		717—8	
$\frac{1}{2}$		3588—8	
202--10--0 <i>facit.</i>		179--8--4 <i>facit.</i>	

19 C. $\frac{1}{4}$ 11 Pound gross, Tare 18 Pound per Cent. at 7 d. $\frac{1}{2}$ per lb. neat.	20 C $\frac{1}{2}$ 13 Pound gross, Tare 12 Pound per Cent. at 10 d. per Pound neat.
34 C. $\frac{1}{4}$ 19 Pound gross, Tare 7 lb per Cent. at 11 d. per lb. neat.	86 C. $\frac{1}{2}$ 13 Pound gross, Tare 13 lb. per Cent. at 8 d. per lb. neat.
13 C. $\frac{1}{2}$ gross, Tare 22 Pound per Cent. at 16 d. per Pound neat.	19 C. $\frac{1}{4}$ 19 Pound gross, Tare 19 lb. per Cent. at 18 d. per lb. neat.

C H A P. XVII.

The DOUBLE RULE of THREE.

HAving somewhat at large insisted upon the two last Rules, *viz. The Rule of Three and Practice* ; I come to the second Rule of Proportion ; commonly called, *The Double Rule of Three*, which hath its Denomination from its double working ; And as I did in the former *Rule of Three*, proceed with one plain and easy working of the same, either *Direct* or *Indirect* : So I shall here also observe the same order ; but here first a diligent Heed must be had unto the stating of the Question ; because under this Rule are comprehended divers Rules of *Plural Proportion*. Therefore observe as in the former *Rule of Three* ; so in this,

1. That first and third Numbers be both of one Species ; *viz.* if the first Numbers be Principal ; the third must be Principal ; if the first be Interest ; the third must be Interest.

If the first be Time ; the third must be Time ; if the first be Men ; the third must be Men.

2. Observe that the two first Terms in the Question, do consist of a Supposition ; and the third Term of Demand.

Example.

If 100*l.* in 12 Months gain 6*l.* what shall 276*l.* gain in 18 Months ?

1. Here you see the Supposition is,

If 100 l. gain 6 l.

2. The Demand is,
What will 276 l. gain ?

100 l. ——— 6 l. ——— 276 l.

20 ——— 1440

120 ——— 11040

12 ——— 1104

276

1440

3974 | 40

Cut off the two first
Figures and the rest are
Pence, viz. 3974 d.

Then say,

If 12 Mon. ——— 3974 d. ——— what will 18 Mon.
facit 5961 d.

If 6 Clerks, can write 45 Sheets of Paper in 5
Days ; how many Clerks can write 300 Sheets in
13 Days, after that Proportion ?

Sheets. Clerks. Sheets.

45 ——— 6 ——— 300

6

1800

1800 (40 Clerks.

458

4

Days. Clerks. Days.

5 ——— 40 ——— 13

5

200

G 4

* Of Berce

* Observe here ; and so in others ; whether the De-
mand be more or less, and
mark as hath been taught.

If the Carriage of 56 C. weight 100 Miles, cost 14/; what will 13 C. cost being carried 29 Miles, after that rate?

C.	1.	C.
56	14	13
		14
	(11(4	
	x 82	52
	86	13
		182

If 100 Miles—3 l. 5 s.—29 Miles?
20 65

$$\begin{array}{r} 36.55 - 29 \text{ Mi} \\ \underline{20} \\ 65 \end{array}$$

If 8 Taylors make four Suits of Cloaths in 10 Days; how many will make 15 Suits in 14 Days?
If 4 Suits — 8 Taylors — 15 Suits? 8

X20 (30 facit
KK

Chap. XVII The Double 129

If 10 Days — 30 Ta. — 14 Days?
Answ. 21 Taylors

$$\begin{array}{r} 2 (6 \\ 300 \\ \hline 300 \\ 300 \end{array} \quad \begin{array}{r} 300 \\ 300 \\ \hline 300 \\ 300 \end{array}$$

Of what Principal was 150*l.* gained in 19 Months, when 100*l.* in 12 Months gained 6*l.*?

facit 1578 *l.* $\frac{1}{9}$ *Principal*

How long time was 200*l.* gaining 42*l.* when 6*l.* was gained of 100*l.* in 12 Months?

facit 93 Months $\frac{1}{3}$.

A Scrivener lent 700*l.* at Interest the 22 of October, 1639, and upon the 9th of Decem. 1645 received for the Interest thereof 330*l.* I demand at what Price per Cent. per Annum. it was lent?

The time is 6 Years,

1 Month, 17 Days.

facit 7*l.* $\frac{1}{3}$ $\frac{2}{3}$ $\frac{8}{5}$ $\frac{7}{5}$

If I sow 20 Bushels of Pease, and they produce in one Year 276 Bushels; I demand how many Bushels in 6 Years, will 90 Bushels produce in that Proportion.

What is the Principal that gained 476 *l.* in 16 Months, when 100*l.* in 12 Months gained 6 *l.*

facit 7452 Bushels 5950*l.* *Principal.*

In what time was 850*l.* gained of 940 Pounds; when 100*l.* in 12 Months gains 6 Pounds?

facit 15 Years, 25 Days $\frac{2}{3}$ $\frac{4}{7}$

If 100*l.* in 12 mon. gained 5*l.* what Money was that which gain'd me in 8 Months 10*l.*?

facit 250*l.* *Principal.*

If 4*s.* 8*d.* pay 1 Soldier for 1 week, how many Dollars at 4*s.* 2*d.* will pay 80 Men for one Month

facit 358 Dollars $\frac{2}{5}$

An G 5

130 *The Double, &c.* Cha. XVII.

An Usurer lent the 11th of July 1647 a Sum of Money at Interest for 6 l. per Cent. and on the 27th of February 1651, received for Interest thereof 218 l. 12 s. I demand what was the Sum lent?

*The time between the
11th of July 47. to
the 27th of February 51.
is four Years, 7 Mon.
16 Days.*

facit 1148 l. 16 s 8 d

If 10 Brick-layers make a Wall of 100 Foot long, and 20 Foot high in 12 Days; how many Brick-layers will make a wall of 236 Foot long, and 20 Foot high in 16 Days?

facit 16 Men $\frac{7}{12}$.

CH A P. XVIII.

A most brief and compendious Way of working all manner of Questions of Interest upon Interest.

Example:

1st, State your Question thus:

F If 100 l. gain 6 l. what the Principal?

2. Multiply the second and third Numbers together, and divide by your first, which is done by cutting off the two first Figures of the Pounds with a Line.

3. Multiply them by 20, by 12, and 4, and all above two Figures in each Multiplication carry over the Line to the left, as you see in the following Examples.

If 100 l. in 12 Months gain 6 l. what will 356 l. gain in 18 Months?

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If 100 l. ——— 6 l. ——— 356 l.
6

l. s. d.
12 Mon. fa. 21 — 07 — 2 $\frac{1}{4}$
6 Mon fa. 10 — 13 — 7

—————
32 — 00 — 9 $\frac{1}{4}$

—————
21 | 36
 20
———
 7 | 20
 12
———
 2 | 40
 4
———
 1 | 60

Observations.

1. * Note, *The Simple Interest for any Summ for one Year ; may be readily found by this Analogy ; viz. As 100 l. Principal, To the Rate of Interest given : So is the given Principal, To the Interest Required ; for one Year ; which being found, and Multiplied by any Number of Years, proposed, the Product is the Simple Interest, for those Years sought.*

2 Note, *To find Simple Interest, for any Number of Months, or Weeks, less than a Year, Divide the Years Amount by the even Parts they make of a Year, and the Quotient is the Answer sought. Or otherwise Multiply the Interest found for any Principal and Rate given, for one Year, by the Number of Months, or Weeks propos'd ; and Divide the Product of the former by 12 ; And the latter by 52 ; the Quotient for each, is, Accordingly, the Simple Interest, for the Months, or Weeks sought.*

3. * Note, *If the Principal given, has any Odd Money in it, and the Time, Weeks, or Days ; then in such Case, it's proper to bring your Principal, into*

£ 6

its least Denomination, and Multiply it by the Number of Days : And if at 5 per Cent. Divide the Product by 7300, the Quotient gives the Answer in the same Denomination the Principal was Reduced into : seeing the Divisor aforesaid or any other, may be exactly found, by Dividing always the Product of 36500 (viz. 360 + 100) by the given Rate, at 4, 5, 6, 7, 8, &c. per Cent. per Annum, the Quotient is the proper Divisor, by which the Principal in its lowest Name proposed, is to be Divided by, as above.

275 l. let out for three Years, at 6 l. *per*, *Cent.*
per Annum.

100 ————— 6 ————— 275₆

	<i>l.</i>	<i>s.</i>	<i>d.</i>	
1 Yard fair	16	10	0	Then
				20
				3

3 Years will be }
3 times this Sum }
10100

2361 10 s 5 d. let out for 16 Months, at 6 l.
per Cent. per Annum

$$\log 1. \text{---} 6 \text{---} 236 \text{---} 10 \text{---} 5$$

<i>Ma.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>	
	14	19	02	06
<i>facit</i> in 12:	14—3—9 $\frac{1}{4}$	20		
$\frac{1}{4}$	4-14—7 $\frac{1}{4}$			

No.	l.	s.	d.
16 :	18 :	18—	5
3			60
			90

III

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The same Order observe for Interest upon Interest; only add the last Interest to the third Number of the last Question, and work as before in these Examples following.

417 l. 11 s. 8 d. let out for four Years, at 6 l. per Cent. per Annum, Interest upon Interest.

$$\begin{array}{r} \text{l.} \qquad \text{l.} \qquad \text{s.} \qquad \text{d.} \\ 100 \text{ --- } 6 \text{ --- } 417 : 11 : 8 \\ 6 \end{array}$$

$$\begin{array}{r} 25 \mid 05 : 10 : 0 \\ \text{--- } 20 \end{array}$$

$$\begin{array}{r} 1 \mid 10 \\ \text{--- } 12 \end{array}$$

$$\begin{array}{r} 1 \mid 20 \\ \text{--- } 4 \end{array}$$

$$\begin{array}{r} \mid 80 \\ \text{---} \end{array}$$

Multiply second and third Numbers together, saying, 6 times 8 Pence is 48 Pence, which is 4 Shillings, set down 0 and carry 4 to the Shillings, saying, 6 times 11 is 66, and 4 that I carried is 70 Shillings; set down the 10 s. and carry 3 to the Pounds, saying, 6 times 7 is 42, and the 3 that I carried is 45, set down 5 and carry 4, saying, 6 times 1 is 6, and 4 that I carried is 10, set down 0 and carry 1, saying 6 times 4 is 24, and 1 that I carried is 25, which set down, and cut off the two first Figures of the Pounds, and multiply as before, and the Product will be according to the Examples, 25 l. 1 s. 1 d. simple Interest for the first Year, the which add to your former Principal

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Principal 417 *l.* 11 *s* 8 *d.* and it will make 442 *l.* 12 *s.* 9 *d.* Then state your Question again, saying,

l. *s.* *d.*
If 100 *l.* ——— 6 *l.* ——— 442 ——— 12 ——— 9
6

26	55	16	6
20			

11	16
12	

1	98
4	

3	92
<i>l.</i>	<i>s.</i> <i>s.</i>

Add this Interest unto the 442 — 12 — 09 and it will make ——— 469 — 03 — 10 $\frac{3}{4}$

Then state your Question again, and work as before, saying,

l. *s.* *d.*
100 *l.* ——— 6 *l.* ——— 469 ——— 3 ——— 10 $\frac{3}{4}$
6

l. *s.* *d.*
Third Year 28 ——— 3 ——— 0 $\frac{1}{4}$
28 | 15 — 3 — 4 $\frac{1}{2}$
20

Which 28 *l.* 3 *s* 0 *d.* $\frac{1}{4}$ 3 | 03
add unto the 469 *l.* 3 *s.* 12
10 *d.* $\frac{3}{4}$, *facit* 497 *l.* 6 *s.* 40
11 *d.* Then state your Question again, and
work as before, saying, 1 | 62

100 *l.*

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100 l. ——— 6 l. ——— 497 l. ——— 6 s. ——— 11 d.
6

29		84	—	1	—	6
		20				

Which being added to
 the 497 l. 6 s. 11 d. fa-
 cit 527 l. 3 s. 8 d. $\frac{3}{4}$ In-
 terest upon Interest for
 4 Years at 6 l. per Cent.
 per Annum.

16		81
9		78
		4
3		12

And thus you may in a brief manner work all Questions of this nature. Other ways of working there are, of which I shall give you two or three. Examples, and leave them to your Consideration.

Example.

I demand how much the Interest of 819 l. will amount unto for 3 Years, 7 Months, 18 Days, after 6 l. per Cent. per Annum, Interest upon Interest ?

Observations

Observations.

1. * Note, In Example of Compound Interest the Amount is found for any Number of Years, by Multiplying the given Rate for 1 l. and its Simple Interest, for one Year, at any Rate propos'd, (which at 4 l. per Cent. is, 1 l. 04, at 5 l. per Cent, is 1 l. 05, at 6 l. per Cent, is 1 l. 06, &c) so often into its self, as are the Number of Years propos'd, wanting one, And the last Product, by the Principal given, will give you the Amount Requir'd.

2. * Note, The Amount of any Annuity, or, Yearly Pension, being for-born any Number of Years whatsoever, at any Rate of Compound Interest, may be found by Multiplying the first Yearly Payment, by the Rate; And to the Product, Add the 2d. Yearly Payment, the Summ is the Amount in two Years, which being Multiplied again by the Rate, the Product, with the Addition of the third Yearly Payment, is the Amount for 3 Years, &c. See Example 1st in Interest upon Interest.

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If 100 = ——— 106 ——— ——— 819
20

16380

12

196560

106

1179360

1965600

208353(60 first year

106

1250118

2083530

220854(18 second year

106

1325124

2208540

234105(24 third year.

106

1404630

2341050

248151(30 4th year from

234105 which subst. the 3d.

14046 one year.

7023 : 6 mo.

1170 : 1 mo.

585 : 15 days

117 : 3 days

234105 : third year

facit 243000 d.

A Table

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A T A B L E to find out what any Sum of Money will amount unto for 21 years, or under, at 6 l. in the Hundred, Interest upon Interest.

l.	s.	d.	q.
1	1	2	1
2	1	2	5
3	1	3	9
4	1	5	3
5	1	6	9
6	1	8	4
7	1	10	0
8	1	11	1
9	1	13	9
10	1	15	9
11	1	17	1
12	2	0	2
13	2	2	7
14	2	5	2
15	2	7	1
16	2	10	9
17	2	13	10
18	2	17	0
19	3	0	5
20	3	4	1
21	3	7	1

The Table is so plain, that I suppose it needs very little demonstration, I shall therefore only give you one or two Examples.

As,

If you would know what 36 l. comes to, Interest upon Interest, for 20 years.

Look against Number 20 in the first Column, and you will find what the Interest upon Interest of one pound comes to for that time. Then say by the Rule of Three,

If 1 l. — 3 l. 4 s. 1 d. 2 q. — 36 l.

3. * Note, All other Tables of Compound Interest, being Calculated in the same manner, for 1 l. Principal at any other Rate propos'd, viz. at 3, 4, 5, 7, 8, 9, 10 l. per Cent. per Annum. You will thereby find readily, the Amount for the same Number of Years at any Principal given, according to the same Method, as above.

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I desire to know how much 346 pound will amount unto in 13 year, Interest upon Interest, at 6 pounds *per cent*.

Look against Number 13 in the first Column, and you will find

l. s. d. q.
2-2-7-3

Then say as before,

l. s. d. q. l.

If I be 2-2-7-3-346

20

42

12

511

4

2047 gr.

346

12282

8188

6151

708262

32

2 (2

8986

708262

(7708

5

1247515

444444

422222

XXXXX

737-15-5 1/2 facit

A very Brief and Necessary TABLE to find out the present Worth of the Annuity or Yearly Rent for 21 Years or under, after the Rate of Six Pounds per Cent. per Annum.

<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>q.</i>	
100	18	10	2	For the understanding of
201	16	08	0	this Table, the same order is
302	13	05	2	to be observed with the for-
403	03	09	2	mer: As for Example,
504	04	02	3	
604	18	04	0	
705	11	07	3	If you would know what
806	04	02	2	one pound yearly Rent is worth
906	16	00	2	for 7 years in ready money.
1007	07	02	2	
1107	17	09	0	
1208	07	08	0	
1308	17	00	2	the first Column, and you will
1409	05	11	9	find what 1 pound is worth for
1509	14	02	5	7 years, viz. 5—11—7 $\frac{3}{4}$.
1610	02	01	1	
1710	09	06	2	
1810	16	06	1	
1911	03	01	3	Now to know what any o-
2011	09	04	3	ther Annuity (as 40 <i>l.</i> <i>£7c.</i>) is
2111	15	03	1	worth for the same time, say
				by the Rule of Three.

	l.	s.	d.	q.	l.
If 1 l. be	—	5	—	11	—
				7	—
				3	
					what
				l.	s.
					d.
					40
					facit
					225
					—
					10

I have a Shop, a Place, or an Office, &c. worth 60 pound *per annum* for 21 years, and would sell it for ready money; the question how much it is worth? Look against Number 21, and you will find one pound a year is worth for that time 11 l. 15 s. 3 d. 1 qr. Then say,

If 1 l. be worth 11 — 15 — 3 d. $\frac{1}{4}$ what shall 60 l. be?

	l.	s.	d.
facit	705	—	16
			3

What is 10 l. *per annum* worth in ready money for 4 years and $\frac{1}{2}$ to come at 6 l. *per cent.*

facit 38 l. 7 s. 7 d. $\frac{1}{4}$

First see the Table what 1 l. is worth for 4 years.

facit 3 l. 9 s. 3 d. $\frac{1}{2}$

Then say, if 1 l. be worth 3 l. 9 s. 3 d. $\frac{1}{2}$ what shall 10 l. *facit* 34 l. 12 s. 11 d. Now to find what the $\frac{1}{2}$ years is worth, see in the Table what one 1 l. is worth for 5 years.

facit 4 l. — 4 s. — 2 d. $\frac{3}{4}$

Then

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Then say, if 1 be 4l. — 4s. — 2d. 3^{qr}—10
 From which subtract the 4th year, 3 years 42 l. 2 s. 3 d. $\frac{1}{2}$
 and the remains will be for 1 year, then 4 years 34l. 12s. 11 d.
 take the $\frac{1}{2}$ of it, 1 year 7l. 9 s. 4 d. $\frac{1}{2}$
 which will shew what the $\frac{1}{2}$ year is $\frac{1}{2}$ year 3 l. 14 s. 8 d. $\frac{1}{2}$
 worth, *facit*. 3 l. 14 s. 8 d. $\frac{1}{2}$, which add to the *facit* of the
 4th year, and it maketh 38 l. 7 s. 7 d. $\frac{1}{4}$

CH A P. XIX.

The Rule of Fellowship without Time.

1. **I**N the working of this Rule, there is no difference betwixt it and the Rule of Three, where every man's particular Stock being added together, the Total must be the first Number in the Rule of Three, the gains the second, and every mans particular Stock the third.

The use of this Rule is therefore to give to each Partner his just and equal share.

Observe then,

I. As the whole Stock is to the whole Gain, so is every man's particular Stock to every man's particular Gain.

Example.

For
 C. P
 2000

If
 who
 T
 Shee
 T
 second
 how

If
 II
 E
 —
 —
 put
 man

Ch

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Example.

Two Merchants Company, *A* put in 20 *l*. *B*. put in 40 *l*. and they gained 50 *l*. I demand each man's part of the gains?

A. 20 *l*.
B. 40 *l*.

If 60 *l*. gain 50 *l*. what shall 20 *l*?
facit. 16 *l*. 13 *s*. 4 *d*. *A*.

If 60 *l*. gain 50 *l*. what will 40 *l*.
facit. 33 *l*. 6 *s*. 8 *d*. *B*.

50—00—00

If both the Shares added together, make up the whole gains, then is the work right.

Three Farmers hired a Shepherd to keep their Sheep, for 7 *l*. 10 *s*. per annum.

The first committed 430 Sheep to his care; the second 357; and the third 500 Sheep: I demand how much each man must pay of this 7 *l*. 10 *s*.

l. *s*. *d*.

A. must pay 2—10—1

$\frac{21\frac{1}{2}}{23\frac{3}{4}}$

B. must pay 2—01—7

$\frac{1\frac{1}{2}}{23\frac{3}{4}}$

C. must pay 2—18—3

$\frac{128\frac{1}{2}}{23\frac{3}{4}}$

Proof 7—10—0

Four Merchants ventured to Sea a Stock of 2475 pounds, whereof *A* put in 710 *l*. *B*. put in 960 *l*. *C*. put in 207 *l*. *D*. put in 598 *l*. and they gained 2000 *l*. But tempestuousness of weather arising

wer

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were forced to cast over-board as many Good as amounted to 769 *l*. I demand what each man must bear of this loss?

$$\begin{array}{r} 710 \text{ l. } A. \text{ must bear } 220 \frac{14}{100} \\ 207 \text{ } B. \text{ } 28 \frac{24}{100} \\ 598 \text{ } C. \text{ } 64 \frac{7}{100} \\ D. \text{ } 185 \frac{12}{100} \end{array}$$

facti 769

Four Grocers laid in a Stock containing these several Sums following, A. put in 120*l*. B. put in 136 *l*. C. put in 180 *l*. D. put in 210 *l* and with it they bought a parcel of Fruit, by which they gained 398 *l*. I demand each man's part of the gains?

$$\begin{array}{r} 120 \text{ l. } A. \text{ } 73 \frac{6}{100} \\ 136 \text{ } B. \text{ } 83 \frac{64}{100} \\ 180 \text{ } C. \text{ } 110 \frac{4}{100} \\ 210 \text{ } D. \text{ } 129 \frac{24}{100} \end{array}$$

facti 398 1938 13
646

Three Merchants made a Company, A. put in a certain sum of money, B. put in as oftentimes 5*l*. as A. put in 4*l*. C. put in as oftentimes 7*l*. as B. put in 6*l*. And they have gained together a certain sum of money whereof A. his part is 100*l*. I demand B. and C's part, and whole gains?

$$\begin{array}{r} 4 \text{ } 100 \text{ } 5 \text{ } \textit{facti} 115 \text{ } B. \\ 6 \text{ } 125 \text{ } 7 \text{ } \textit{facti} 145 \frac{1}{2} \text{ } C. \\ \textit{facti} 100 \text{ } A. \end{array}$$

370 $\frac{1}{2}$
T

Ch. XVIII. Rule of Fellowship. 145

Two Merchants made a Company, *A.* put in 350*l.* and they gained together 166 *l.* of which *B.* must have 10 offentimes 10 *l.* as *A.* must have 6 *l.* I demand how much money *B.* put in the Company?

Always observe that every man muſt have according as he hath put in, then conſider if

6—350—10
facit. 583 l. $\frac{1}{3}$ B. put in.

Two Men Company, and make a Stock of 700 *l.* whereof *A.* put in 300 *l.* and they have gained together 200 *l.* I demand what each man muſt have of the gains?

$\left\{ \begin{array}{l} A \text{ 300 l: fait 102 l-17-11 } \frac{5}{2} A. \\ B \text{ 400: fait 137--02--10 } \frac{7}{4} B. \end{array} \right.$

240-00-00

Three Merchants made a Company, *A.* put in 600 *l.* *B.* put in fo oftentimes 50 *s.* as *A* put in 40 *s.* *C.* put in fo oftentimes 70 *s.* as *B.* put in 60 *s.* and they gained together 500 *l.* I demand what each man put in, and muſt have of the gains?

In questions of this nature, the particular Stocks unmentioned, must be found out by that which is mentioned.

As for example, to find what Stock *B*. put in.

If $\frac{4}{5}$ — 600 l. — $\frac{5}{4}$ — fair 750 l. B.

H

Such

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Such reason as 6 hath to the Money which B. put in, such reason must 7 have to the money which C. put in: As,

$$\text{If } \frac{6}{750 \text{ l.}} = \frac{7}{\text{facit } 875 \text{ l. C.}}$$

600 A.
750 B.
875 C.

$$\begin{array}{r} 1 \text{ } \{ 2225 \text{ --- } 500 \text{ l. --- } 600 \text{ A. } 2225 \\ 2 \text{ } \{ 2225 \text{ --- } 500 \text{ --- } 750 \text{ B. } \\ 3 \text{ } \{ 2225 \text{ --- } 500 \text{ --- } 875 \text{ C. } \end{array}$$

2225

Three Merchants made a Company, D. put in 437 l. E. put in 211 l. and they have gained together 562 l. whereof F. must have 187 l. 15 s. demand D. and E's part, and what F. put into the Company?

To find what F. put in, first subtract his particular from the whole gain.

$$\begin{array}{r} \text{l.} \\ 562 \text{ --- } 00 \\ 187 \text{ --- } 15 \\ \hline 374 \text{ --- } 05 \\ \hline \end{array}$$

Then

Ch. XIX. Rule of Fellowship. 147

Then add D. and E's Stock together.

437 D.
211 E.

648

Gain.		Stock.		Gain.
374 l. 5 s.	—	648	—	187 l. 15 s.
facit, 325 l.				748 $\frac{1}{2}$

Then to find D and E's part of the profit.

Stock, l.	s.	Stock.
648 —	374 —	5 —
		437 D.
648 —	374 —	5 —
		211 E.

Fellowship with Time.

III. The use of this part is the same with the former, and differeth not in operation, save in this that every mans Stock is multiplied by his Time, and the total of those products added together is the first Number, the gain or loss the second Number, and every mans particular Stock and Time the third.

Observe then,

IV. *As the whole Stock and Time is to the whole loss or gain : So is every mans particular Stock and Time, to every mans particular loss or gain.*

H 2

Example.

148 Rule of Fellowship. Ch. XIX.

Example.

Two Merchants Company, *D.* put in 100 l. for 4 months. *E.* put in 136 l. for 3 months, and they gained 50 l. I demand each man's part of the gain?

Mo.

D. put in 100 l. 4 ——— 400
E. put in 136 l. 3 ——— 408

808

808 ——— 50 l. ——— 400 *facit* 24 $\frac{608}{808}$
 808 ——— 50 l. ——— 408 *facit* 25 $\frac{808}{808}$

50

Three Butchers hired a piece of ground for 12 l. 10 s. 6 d. *A.* put in 20 Oxen 5 days, *B.* put in 16 Oxen 7 days, *C.* put in 25 Oxen 4 days: I demand how much each Butcher ought to pay for his proportion?

Ox. *da.*

A. put in 20 ——— 5 ——— 100
B. put in 16 ——— 7 ——— 112
C. put in 25 ——— 4 ——— 100

312

l. s. d.
 312. ——— 12 ——— 10 ——— 6 ——— 100
 l. ——— s. ——— d.
facit 4 ——— 0 ——— 3

$\frac{6}{17}$

312

150 Rule of Fellowship. Ch. XIX.

Three Merchants Company for 18 Mo. *D.* put in 500*l.* and at 5 Mo. took out 200*l.* and at 10 Mo. put in more 300*l.* and at 14 Mo. took out 130*l.* *E.* put in 400*l.* and at 3 Mo. put in more 270*l.* and at 9 Mo. took out 100*l.* and at 12 Mo. put in more 200*l.* and at 15 Mo. took out 99*l.* *F.* put in 900*l.* and at 6 Mo. took out 200*l.* and at 11 Months put in 500*l.* at 13 Mo. took out 600*l.* and they gained 200*l.* I demand each man's part of the gains?

$$\left. \begin{array}{l} D. 8280 : facit 49l. \frac{37}{3} \frac{2}{3} \frac{1}{3} \\ E. 10653 : facit 64l. \frac{36}{3} \frac{8}{3} \frac{2}{3} \end{array} \right\} F. 14300 : facit 86l. \frac{14}{3} \frac{2}{3} \frac{2}{3}$$

$$\begin{array}{r} \text{Proof } 200 \\ \hline 33233 \end{array} \quad 33233 \quad (1 l.$$

Two men men made a Stock of 165 pound wherewith they gained 28 pound which added to the Stock makes 193 pound. *D.* his Money was in 12 months, and *E.* his Money was in but 8 Mo. When they shared the flock and gain, *D.* had 67*l.* and *E.* 126*l.* I demand what each man's Stock?

State your Question thus:

As 12 mo. to 165*l.* so is 8 mo. to 110*l.* for *E*'s Stock, the which subtract from 165, and the Remainder will be 55*l.* for *D*'s Stock.

The Proof.

If 55*l.* in 12 mo. gain 12*l.* what 110*l.* in 8 Months?

$$\begin{array}{rcl} 55 l. & \text{---} & 12 l. & \text{---} & 110 l. & \text{---} & \text{Gains} \\ mo. & 12 & & & 8 mo. & & \\ & & & & & & facit E. 16 l. \\ & & & & & & facit D. 12 l. \\ & & & & & & Or, \end{array}$$

Or,
Having the Stock, you have the Gains by subtracting each Man's Stock, from his Stock and Gain given, without the *Rule of Three*.

Stock and Gain of D. 67 l.
Stock of D. 55

D's Gain 12

Stock and Gain of E. 126
Stock of E. 110

F's Gain 16

So that D with 55 l. Stock gains 12 l. E with 110 l. gains 16 l.

12
28.

CHAP. XX.

Of BARTER.

Barter, is the exchanging Wares for Wares, or one Commodity for another.

Example.

Two Merchants Barter: A hath 3 C. $\frac{1}{2}$ of Pepper, at 13 d. $\frac{1}{2}$ per Pound; B hath Ginger at 15 d. $\frac{1}{4}$ per Pound. I demand how much Ginger must be delivered for the Pepper?

H 4

1. See

1. See what the Pepper is worth, saying, If 1 lb. cost 13 $d \frac{1}{2}$, what cost 3 C. $\frac{1}{2}$?

facit 22 l. 1 s.

2. Say, If 15 $d \frac{1}{4}$ buy 1 lb. of Ginger, what will 22 l. 1 s. buy?

facit 347 $\frac{1}{4}$ Ginger.

Two Men barter: A hath 20 Ells of Cloth at 9 s. 6 d. *per* Ell ready Money; but in Barter, he will have 10 s. 2 d. *per* Ell: B hath *Sersey* Wool at 2 s. 10 d. *per* Pound: I demand how much Wool must be delivered for the Cloth in Barter?

As before, so here:

If 1 Ell in Barter be 10 s. 2 d. what 20 Ells in Barter?

facit 2440 d.

If 34 d buy 1 lb. what will 2440 d. buy?

facit 71 lb $\frac{1}{17}$.

Two Drapers barter, the one hath 472 Yards of Canvas at 16 d. *per* Yard, the other lets him have 38 Pieces of Cloth: The Question is, How much one Cloth stands him in?

facit 16 s. $\frac{1}{3}$.

20 Bags of Hops, each 3 C. $\frac{1}{2}$, battered for 336 C. of Brazil, at 18 s. *per* C. I demand what Price were the Hops sold at?

Answer 4 l. 6 s. $\frac{1}{4}$ *per* C.

A Merchant hath Tobacco, which he will barter at 14 d. *per* lb for Sugar at 10 d. *per* Pound in Barter: I demand how much Tobacco must be given for 8900 lb. of Sugar?

Answer 6357 lb. $\frac{1}{7}$.
Nutmegs

Nutmegs at 4 s. 2 d. *per* lb. ready Money; 5 s. in Barter; how much Pepper at 12 d. *per* lb. be sold to make the like Profit?

Answer 14 d. $\frac{2}{3}$.

How many dozen of Candles at 5 s. 2 d. *per* dozen must be given for 3 C. 2 Qrs. 16 lb. of Tallow at 37 s. 4 d. *per* C?

Answer 26 dozen $\frac{2}{3}$.

A Merchant hath Stockings at 39 s. *per* dozen ready Money; which he will barter at 46 s. *per* dozen, for Canvas at 13 d. $\frac{1}{2}$ *per* Ell, ready Money. I demand what Price the Canvas must bear in Barter, to gain 5 *h.* in the 100 l.?

Answer 16 d. $\frac{1}{2}$ and $\frac{2}{3}$ of $\frac{1}{2}$ d.

Broad Cloath of 6 s. 8 d. the Yard, ready Money, is bartered at 7 s. 9 d. for Wool at 10 d. *per* lb. ready Money: What Price must be made of the Wool in Barter, to gain 11 l. *per* Cent?

Answer 12 d. $\frac{7}{8}$.

D hath Holland of 5 s. *per* Ell ready Money, bartered at 6 s. *per* Ell to E, for Broad-Cloth at 9 s. 6 d. *per* Yard, which cost but 8 s. I demand which gaineth most, and how much *per* Cent?

Answer. D gains 20 l. *per* Cent.
E 18 l. 15 s. *per* Cent.

CHAP. XXI.

OF EQUATION.

THE Rule of Equation of Payments, teacheth to reduce the Times of several particular Payments to one Time for the Payment of the whole Sum.

Example.

If the Question be of this Nature.

A Merchant oweth 500 *l.* to be paid at 3 Payments, *viz.* 300 *l.* at 4 Month, 100 *l.* at 6 Months, and 100 *l.* at 12 Months. The Debtor agrees to discharge the whole Debt at one Payment. Now the Question is, at what Time the Payment ought to be made, without Damage unto the Debtor or Creditor, accounting 6 *l.* per Cent. per Annum Interest.

The Rule is this.

II. Multiply each particular Payment by its Time; then add all the Products together, and divide the Total by the whole Debt.

<i>l.</i>	<i>Mo.</i>
200 multiplied by	4 <i>facit</i> 1200
100 multiplied by	6 <i>facit</i> 600
200 multiplied by	12 <i>facit</i> 1200
Divisor 500	Dividend 3000

3000 6
300

So

So that the Answer to the Question (according to this Rule) is, that six Months is the Time for the Payment of the whole Sum.

III. *For the Proof of this Rule, thus:*

300*l.* ought to be paid at 4 Months, and is not paid till 6 Months that is 2 Months after its time. The Interest of 300*l.* for 2 Months is 3*l.*

Then 100*l.* paid at 6 Months, is the Time equated.

The other 100*l.* to be paid at 12 Months, is paid 6 Months before its time; and the Interest thereof for 6 Months, is likewise 3 Pounds.

Which sheweth the Rule to be true, and at 6 Months is the time for the Payment of the whole Sum, and thereby neither the Debtor nor Creditor is damaged according to the Law.

A Merchant oweth 450*l.* to be paid at 3 Payments, $\frac{1}{3}$ at 3 Months, $\frac{1}{3}$ at 5 Months, and $\frac{1}{3}$ at 8 Months, and the Debtor and Creditor agree, that the whole Sum sh^{al} be paid at one time: The Question is, what Time ought the whole Sum to be paid in; so that neither the one nor the other may be damaged.

The Rule is to multiply each Part by its Time, thus

$$\begin{array}{r} 3 \\ \hline \frac{1}{3} \text{ by } 3 \text{ facit } 1 \text{ Mon.} \end{array}$$

3

5

$$\begin{array}{r} \frac{1}{3} \text{ by } \frac{1}{3} \text{ facit } 1 \text{ Mon. } \frac{2}{3} \end{array}$$

H 6

$$\frac{3}{8}$$

$$\frac{1}{2} \text{ by } \frac{2}{1} \text{ facit 2 Mon. } \frac{1}{2}.$$

$$3$$

$$\text{facit 5 Mon. } \frac{1}{2}$$

A Merchant oweth 300 *l.* to be paid $\frac{1}{2}$ at 3 Months and $\frac{1}{3}$ at 6 Months, and $\frac{1}{4}$ at 12 Months I demand at what Time the said Sum ought to be paid together?

$$3$$

Mo.

$$\frac{1}{3} \text{ by } \frac{2}{1} \text{ facit 1.}$$

$$\frac{3}{6}$$

$$\frac{1}{3} \text{ by } \frac{1}{1} \text{ facit 2.}$$

$$3$$

12

$$\frac{1}{2} \text{ by } \frac{2}{1} \text{ facit 4}$$

$$3$$

$$\text{facit 7 Mo. } \frac{1}{2}$$

To prove the Certainty of this manner of Operation you may take the same Course as before, 7 Months being the Time for the Payment of the whole Sum.

See first what the Interest of the Money comes to, that should have been paid before the 7 Months: And then see what the Interest of the Money comes to, that should have been paid after the 7 Months: And if the Interest of the one Part be equal with the Interest of the other, then is the former Operation right; and 7 Months must needs be the just Time. As for Example.

100 *l.*

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100 *l.* should have been paid at 3 Months, but now is not paid till 7 Months, so that the Interest for that 100 *l.* must be accounted for the 4 Months delay, which Interest is $\text{---} \text{---} \text{---} 2 \text{ l.} \text{---} 0 \text{ s.}$

100 *l.* more should have been paid at 6 Months, and now is delayed till 7 Months. The Interest for that is $0 \text{ l.} \text{---} \text{---} 10 \text{ s.}$

facit 2 *l.* $\text{---} \text{---} 10 \text{ s.}$

The other 100 *l.* is paid 5 Months before its Time, and the Interest thereof for 5 Months is likewise $\text{---} \text{---} 2 \text{ l.} \text{---} \text{---} 10 \text{ s.}$ equal with the former, which shews the Operation to be right,

There is owing to a Merchant 340 *l.* to be paid 80 Pounds ready Money, 100 *l.* at 3 Months, and 160 *l.* at 8 Months, I demand what is the indifferent Time for the Payment of the whole?

IV. In Questions of this Nature, set down the particular Sums and the several times of Payment thus:

l *Mo.*

80 $\text{---} \text{---} 00$
100 $\text{---} \text{---} 03$
160 $\text{---} \text{---} 08$

Then multiply each Sum by its Time of Payment, and the Work will stand thus.

Add all the Products together, and divide the Total by the whole Debt.

8	0	0	0	00	0
10	0	0	0	30	0
16	0	0	0	128	0

34 Divisor 158 Dividend.

(2)2

288 (4 1/4 facit.

34

There

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Equation.

Chap. XXI.

There is 245 *l.* 10 *s.* 9 *d.* to be paid $\frac{1}{3}$ at 6 Months, 1 at 8 Months, and the rest at 12 Months. What is the indifferent time for the Payment of the whole Sum together?

This Rule is laid down in the first and second Examples, Multiply each Part by its Time.

$$\begin{array}{r} \frac{1}{2} \frac{1}{3} \frac{1}{6} \\ \frac{1}{2} \frac{1}{3} \frac{1}{6} \end{array} \left. \begin{array}{l} \text{by} \\ \end{array} \right\} \begin{array}{r} 6 \\ 8 \\ 12 \end{array} \left. \begin{array}{l} \text{facit.} \\ \end{array} \right\} \begin{array}{r} 3 \\ 2\frac{2}{3} \\ 1 \end{array} \left| \begin{array}{l} \text{The Certainty here-} \\ \text{of is demonstrated by} \\ \text{the Proof of the third} \end{array} \right.$$

facit Mo. 7 $\frac{2}{3}$

Example.

A is indebted unto *B* 300 *l.* to be paid 100 *l.* at 4 Months, and 200 at 8 Months. And *B* oweth unto *A* 500 *l.* to be paid at 10 Months. It is agreed between them, *A* shall make present pay for his whole Debt, and *B* shall pay his so much the sooner, as shall countervail that Favour: I demand at what Time *B* must pay the 500 *l.* reckoning simple Interest?

V. For the Resolution of this, and the like Questions, first see by the former Rule what time *A* ought to pay in his whole Money.

$$\begin{array}{r} 1 \mid 00 \} \\ 2 \mid 00 \} \text{ at } \{ \begin{array}{r} 4 \text{ --- } 4 \\ 8 \text{ --- } 16 \end{array} \end{array}$$

Mo.

$$\begin{array}{r} (2) \\ 206\frac{2}{3} \end{array}$$

Then see by the Rule of Three,

$$\begin{array}{r} \text{If } 3 \text{ --- } 6\frac{2}{3} \text{ --- } 5 \\ 20 \text{ (4 Mo. facit.} \\ 8 \end{array}$$

Which

Which 4 Months are to be subtracted from 10 Months, (the Time that B ought to have paid in his Money) and there remain 6 Months.

Observe, For the Proof; hercof see first what the Interest of 300 *l.* comes to for 6 Months $\frac{2}{3}$

Then see what the Interest of 500 *l.* comes to for 4 Months. If both the Sums be alike, then is the former Work true.

A Merchant hath a certain Sum of Money owing to him, to be paid at 7 Months; his Debtor doth agree to pay him half ready Money, and $\frac{1}{3}$ at 4 Months: I demand what time he must have to pay in the rest, so that neither Party may have Advantage of the other, without reckoning Interest upon Interest?

VI. For the Resolution whereof, it matters not what the Sum was I but you may work the same by any Number that will easily admit of the Parts mentioned in the Question. And for our present use, we will imagine the Sum that was to be paid at 7 Months, 60 *l.*

Whereof $\frac{1}{2}$, that is 30 *l.* must be paid content. And $\frac{1}{3}$, which is 20 *l.* must be paid at 4 Months. Then see what the Interest of these two Parts comes to, for the time in which they were paid before they were due.

The Interest of

30	for	7	is	21
20	}	}	}	}
	30	20	3	06

Sum 27

Now that which remains for a full Resolution of the Question, is only this:

To

To find out how long time the remaining Part of the Sum, (which is 10 *l.*) must be retained, that the Interest thereof may come to 27 *s.*

And that is done by the Rule of Three, thus,
The Interest of 10 *l.* for 1 Month is 1 *s.*

If 1 *s.* ——— 1 *mo.* ——— 27 *s.*

facit 27 *Mo.*

Unto which add the 7 Months }
allowed at first ————— 07

facit 34 *Mo.*

A Merchant hath owing him 500 *l.* to be paid him at 8 Months, and his Debtor doth agree to pay him 200 *l.* at 3 Months, on condition that he shall let him have the rest for so much the longer: The Question is, when he must pay the rest with Interest upoo Interest?

As in the former Question, so in this.

First, see what the Interest of 200 *l.* comes to for 5 Months, paid before the Time.

The Interest of 200 *l.* for 5 Months comes to 5 *l.*

Then by the Rule of Three see how many Months 300 *l.* must be let out, that so the Interest thereof may come to 5 *l.*

facit 3 $\frac{1}{3}$ Months.

To which add the 8 ———

facit 11 $\frac{1}{3}$

A Merchant hath owing to him 146 *l.* 10 *s.* 9 *d.* to be paid $\frac{1}{3}$ content, $\frac{1}{4}$ at 3 Mon. $\frac{1}{4}$ at 5 Months, and the rest at 7 Months; and his Debtor doth agree to pay him all at one Payment: I demand when that Payment must be made, that neither have Advantage of the other?

Mo.

$$\begin{array}{r}
 \text{Mo.} \quad \text{Mo.} \\
 \left. \begin{array}{l} \frac{1}{3} \\ \frac{3}{4} \\ \frac{1}{1} \\ \frac{1}{7} \\ \frac{1}{20} \end{array} \right\} \text{ at } \left\{ \begin{array}{l} 0 \text{—} 0 \\ 3 \text{—} 0 \\ 5 \text{—} 1 \\ 7 \text{—} 1 \end{array} \right. \begin{array}{l} 0 \\ \frac{2}{4} \\ 1 \\ \frac{3}{6} \end{array} \\
 \hline
 \text{facit } 3 \text{ } \frac{4}{3}
 \end{array}$$

A Merchant hath owing 243 l. 19 s. 11 d. to be paid $\frac{1}{2}$ at 2 Months, $\frac{1}{3}$ at 3 Months, and the rest at 6 Months, the Debtor doth agree to pay $\frac{1}{2}$ content, and the other half at one Payment: I demand when the Payment must be made, that neither may be dammified?

First, do according to the former Rule: What is the indifferent time for the Payment of the whole Sum together?

$$\begin{array}{r}
 \text{Mo.} \quad \text{Mo.} \\
 \left. \begin{array}{l} \frac{1}{2} \\ \frac{1}{3} \\ \frac{1}{3} \end{array} \right\} \text{ at } \left\{ \begin{array}{l} 2 \text{—} 0 \\ 3 \text{—} 1 \\ 6 \text{—} 3 \end{array} \right. \begin{array}{l} 0 \\ 1 \\ \frac{1}{3} \end{array} \\
 \hline
 \text{facit } 4 \text{ } \frac{1}{3} \text{ Mo.}
 \end{array}$$

Now in regard that $\frac{1}{2}$ is paid in 4 Months, and $\frac{1}{3}$ before its due, it is Reason, and according to Rule, that he should have the other $\frac{1}{3}$ 4 Months $\frac{1}{3}$ longer, which being added to the just time of Payment,

$$\text{facit } 8 \text{ Mo. } \frac{2}{3}$$

C H A P.

C H A P. XXII.

The Rule of REBATE or DISCOUNT.

1. **M**ERCHANTS commonly vend their Commodities either for ready Money, or to be paid at a certain time or times appointed, at 3, 4, 6, 12, Months, or the like : but it often happeneth to be very convenient both to the Buyer, and Seller, that this Money be paid in before it be due.

A Merchant sells Goods to the value of 100*l*. to another, to be paid at 12 Months, but the other is willing upon an After-agreement to pay present Money upon Rebate, after 6*l*. per Cent. per Annum, simple Interest. - I demand the Sum paid and rebated ?

Observe Before you lay down the manner of working, observe, that in all Rebatelements, there ought to be no more Money paid than would augment it self to the Sum first due, if it were put forth to Interest, and this may also serve as a sure Proof of this Rule.

How to state the Question.

1. First, see what the Interest of 100*l*. cometh to for the time demanded.
2. Add that Interest to the 100*l*. which must be the first Number in the Question, 100*l*. the second, and the Sum to be rebated the third.

Example

Ch. XXII. The Rule of Rebate. 163

Example.

l. l. l.
If 106 ——— 100 ——— 100
100

—————
10000

$\begin{matrix} (3 \\ 45 \end{matrix} (6$
 $\cancel{100000} (94 \frac{1}{3} \text{ facit.}$ Which put forth to
 $\cancel{100000}$ Interest would be-
 $\cancel{100}$ come 100 l.

I demand how much the Rebate of 289 l. 19 s.
will amount unto for 6 Months, after 8 l. per Cent.
per Annum, simple Interest?

l. s.
104 ——— 100 ——— 289 ——— 19
20

5799
100

—————
579900

$\begin{matrix} (1 \\ 78 \end{matrix} (0$
 $\cancel{8882} (0$
 $\cancel{8738800} (55715$
 $\cancel{100000} 278 — 15 — \frac{2}{26}$
 $\cancel{100000}$

l. s. d.
Was to be paid ——— 289 ——— 19 ——— 00
Is to be paid ——— 278 ——— 15 ——— $\frac{2}{26}$

Is rebated ——— 11 ——— 03 ——— $\frac{3}{1}$

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I demand the Rebate of 321 l. 18 s. for 11 Months, after 6 l. per Cent. per Annum, simple Interest ?

To find the Interest of 100 l.	Example.
for any Number of Months,	Mo. l. s.
you may take the Parts of 12 Months, as thus: If 6 l. be	12—6—00
the Interest of 100 l. for 12 Months, then 6 Months will be	6—3—00
the $\frac{1}{2}$ of that, and 3 Month	3—1—10
the $\frac{1}{2}$ of that $\frac{1}{2}$; and 2 Months	2—1—00
the $\frac{1}{2}$ of that for 6 Months.	5—10
105 l. 10 s. — 100 l. —	321 l. 18 s.
facit 305 l. — 11	

I demand the Discount of 378 l. for two 6 Months, after 6 l. per Cent. per Annum simple Interest ?

By two 6 Months is understood	Mo. l.
that the $\frac{1}{2}$ of the Money is to be	12—.6—378
paid at 6 Months and the other $\frac{1}{2}$	6—3—189
at 6 Months after that.	

l.	l.	l.
103 ———	100 ———	189
l.	l.	facit 183 l. 10 s.
106 ———	100 ———	189
		facit 178 l. 7 s.

I demand the Discount of 760 l. 16 s. for three 4 Months, after 6 Pound per Cent. per Annum simple Interest ?

Mo.

I. Ch. XXII. The Rule of Rebate. 165

Mo.	l.	l.	s.
12	—6	$\frac{1}{3}$ 760	—16
4	—2	253	—12
8	—4	253	—12
12	—6	253	—12

102—100—253—12
facit 248 l. $\frac{3}{4}$ for the first Payment at 4 Months.

104 l. — 100 — 253 l. 12 s.
facit 243 $\frac{11}{12}$ for the second Payment at 8 Months

106 l. — 100 — 253 l. 12 s.
facit 239 l. $\frac{1}{3}$ for the third Payment at 12 Months
 There are other ways for the working of Rebate; but I shall only Instance one more after 6 l. per Cent. As,

First, Multiply the Money and the Time.
 Secondly, Divide that Product by 200 and the Time, and the Quotient is the Sum to be paid upon Rebate.

Example.

What is the Rebate of 100 l. for 12 Months after 6 l. per Cent. per Annum.

$$\begin{array}{r} 100 \\ 12 \\ \hline \end{array}$$

$$\begin{array}{r} 1200 \\ 11(4 \\ \times 28(05 \quad \frac{140}{212} | \frac{170}{178} | \frac{34}{34} \\ \hline 282 \end{array}$$

100 was to be paid.
 5 $\frac{2}{3}$ is to be rebated.

94 l. $\frac{1}{3}$ is to be paid.

And

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And thus you may work any other Question after 6 per Cent. &c.

But if the Rebate be after 8 l. per Cent. then let the Divisor be 150 and the Time.

CHAP. XXIII.

Of EXCHANGE.

1. **T**H E whole Course of Exchange is no more than to pay Money in one Place or Country, and receive in another the like Value or Sum, with Consideration of either Loss or Gain.

I might give you a Catalogue of Foreign Coins, but it will be to little Purpose, because they are not current Money as our *English* is, but do rise sometimes higher in Value, and sometimes lower, according as the Exchange runs. I shall therefore give you some choice Questions, and so leave you to enlarge as you see Occasion.

A Merchant delivered 340 l. *Sterling* at *London* to receive the same at *Amsterdam*, the Exchange at 34 s 7 d. *Flemish*, the 20 s. *Sterling*, I demand the same in *Flemish* Money.

2. Consider the first and third Numbers must be of one kind ; if the first be *Sterling* Money, the third must be so too : If the first *Flemish*, the third must be *Flemish*.

A. Sterl.

S. d. Flem.

1. Sterl.

If 20 --- 34 --- 7 --- 340
12 20

12

0

415
6800

6800

6800

332000

2490

282200 0

$\frac{1}{5}$ 141100 d.

1175.8-4d.

facit 58.7-18-4

Or thus :

340 l. --- at 34 s. 7 d.

34

1360

1020

170

28--4 d.

117518-4d.

587-18-4 facit.

A Merchant received a Bill of Exchange of 8000 Crowns at 5 s. $\frac{1}{2}$ Sterr. I demand the Sum in Ster-ling Money. Say,

If 1 be—5 s. $\frac{2}{7}$, what—8000?
facit 2285 l. 14 s. 3 d. $\frac{2}{7}$

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A Merchant delivered 245 *l. Flem.* at *Middelborough*, to receive the same at *London*, the Exchange at 29 *s.* and 5 *d. Flem.* the 20 *s. Sterl.* I demand the Sum *Sterling Money*?

If 29 *s.* 5 *d. Flem.* be 20 *s. Sterl.* what 245 *l. Flemish*?

facit 166 *l.* 11 *s.* $\frac{2}{3}$ $\frac{1}{4}$

A Merchant of *London* receiveth a Bill of Exchange from *Paris* 460 *l. Sterling*, for the Value delivered there at 84 *d. Sterling*, the 60 *s.* at *Tournoi*. I demand how much was delivered at *Paris Tournois*, when 20 *s.* make one Pound *Tournois*?

84 *d.* — 60 *s.* — 460 *l.*

facit 3942 *l.* 17 *s.* $\frac{1}{7}$ *Tournois*.

A Merchant at *London* delivereth 80 *l. Sterling* by Exchange for *Frankfort* at 40 *d. Sterling* the Florin of 67 *Kreutzers*. The Question is, How many Florins of 63 *Kreutzers* the Florin, he must receive at *Frankfort*?

$\frac{67}{63} (1 \frac{4}{21})$

40 — 1 $\frac{4}{21}$ — 80 *l.*

facit 510 $\frac{10}{21}$

A Merchant at *Danzick* doth receive a Bill of Exchange from *London* 3999 Florins, and is for 376 *l. Sterling* delivered at *London*. I demand at what Price the Pound *Sterling* was delivered, when 30 gros *Polish* make a Florin?

facit 319 $\frac{11}{13}$ gros *Polish*.

At

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At *Antwerp* a Merchant receiveth a Bill of Exchange from *London* of 375 *l. Flemish*, for the Value received there at 27 *s. 5 d. Flem.* the 20 *s. Sterling*: I demand the Sum in *Sterling Money* that was delivered at *London*?

facit 273 *l. 11 s. $\frac{4}{3}$ $\frac{1}{2}$*

A Merchant at *London* doth deliver 370 *l. Sterling* by Exchange from *Roan*, at 73 *d. Sterling*, for 50 *s. Tournois*: The demand is, how much he must receive at *Roan*, *Tournois*?

facit 60821 *s. $\frac{4}{7}$ $\frac{2}{3}$ Tournois.*

A *Spanish Merchant* doth receive a Bill of Exchange from *London* of 700 Duckets, and is for 196 *l. 15 s.* delivered at *London*. I demand at what Price the Ducket was delivered?

facit 5 *s. 74 $\frac{7}{8}$*

III How to know at what Rate we make the Exchange, transporting Money or Wares from one Country to another.

If a Ducket of *Venice* be worth 120 *s.* and at *London* 5 *s. 7 d.* at what Price is the Exchange made for the Ducket of 112 *s.* in transporting from *Venice*?

120 ————— 5 *s. 7 d.* ————— 112 *s.*
facit 5 *s. 2 d. $\frac{8}{15}$*

If a *French Crown* at *Hamborough* be worth 45 *s. 6 d.*, and an Angel be worth 78 *s.* and at *London* *French Crown* is worth 6 *s. Sterling*, and the Angel 11 *s. Sterling*. Whether it is better to bring Angels or *French Crowns* from *Hamborough* to *London*?

It is better to bring *French Crowns*, by $\frac{2}{7}$
I If

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If a Piece of Serge be worth 28*s*. *Sterling*, an at *Frankfort* it is worth (all Charges abated) 17 Florins, at 6 *Kreutzers* the Florin, at what Price do I make the Exchange for 66 *Kreutzers* in carrying Serges from London to *Frankfort*?

facit 1*s*. $\frac{2}{3}$ $\frac{2}{3}$

If a Mark at *Hamborough* be worth 33*s*. *Lubib*, and at *London* 3*s*. 7*d*. at what Price is the Exchange made for 1*l*. *Sterling*, in bringing Marks from *Hamborough* to *London*?

facit 184*s* $\frac{2}{3}$ *Lubib*

If a *French* Crown be worth 7*s*. $\frac{2}{3}$ *Flemish* at *Antwerp*, and 6*s* at *London*, at what Price do I make the Exchange for 1*l*. *Sterling*, in bringing *French* Crowns from *Antwerp* to *London*?

facit 25*s*. $\frac{1}{3}$ *Flemish*

If a Dollar at *Dantzick* be worth 39 *Gros* and at *London* 4*s*. 8*d*. at what Price do I make the Exchange for 1*l*. *Sterling*, transporting Dollars from thence to *London*?

facit 167*s*. $\frac{8}{21}$ *Gros*

CHAP. XXIV.

Of LOSS and GAIN.

1. **I** Need not go about to acquaint you, with the meaning of this Rule, because the Words themselves are sufficient to inform you: and for its Nature, I shall shew it you by many various Questions, which indeed are something hard to apprehend without

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If

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without the well minding of these four principal Heads, which, being well understood, will carry you through the Difficulties thereof.

As,

First, To know what is gained or lost *per Cent*.
Secondly, To know how it shall be sold for, to gain or lose to much *per Cent*.

Thirdly, Having gained or lost so much *per Cent*. to know what it cost.

Fourthly, There being so much gained *per Cent*. when sold for such a Rate: To know what is gained *per Cent*. when sold for more, or what is lost *per Cent*. when sold for less.

Of these in Order.

First, To know what is gained or lost *per Cent*. per Pound, per Ell, per Yard, &c.

Example.

If 1 **℔** of Tobacco cost 18 d. and is sold for 21 d. I demand how much is gained *per Cent*.? *First*, see what the Gain or Loss is by Subtraction.

$$\begin{array}{r} 21 \\ 18 \\ \hline 3 \end{array}$$

Then let the Price it cost be the first Number in the Rule of Three, the Gain or Loss the second, and 100 l. the third.

If 18 l. gain ——— 3 l. ——— what 100?
 facit 16 l. 13 s. 4 d.

1 2

If

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If a Leather-feller buy a Parcel of Leather, for
for 2 s 10 d. *per Skin*, and selleth the same again
for 3 s. 2 d. what doth he gain *per Cent.*?

s.	d.	
3	2	
2	10	
0	4	

If 34 d. gain 4 d. what 100 l.
facit 11 l. 15 s. 3 d. $\frac{7}{2}$

If I buy an Ell of *Holland* for 6 s. 7 d. and sell it
again for 5 s. 9 d. I demand how much the Loss
is *per Cent.*?

s.	d.	
6	7	
5	9	
0	10	

If 6 s. 7 d. 10 d. 100 l.
facit 12 l. 13 s. 1 d. $\frac{7}{5}$

If 1 $\frac{1}{2}$ lb. cost 10 d. and is sold again for 8 d. the
Question is, What is lost *per Cent.*?

If 10 d. lose 2 d. what 100 l.

If a Piece of Cloth, containing 24 Yards, cost
42 s. and 1 Yard is sold for 2 s. 8 d. the Question
is, How much is gain'd or lost *per Cent.*?

gained 52 l. 7 s 7 d. $\frac{1}{2}$ *per Cent.*

If a Piece of Silk, containing 36 Yards cost 9 l.
and 1 Yard is sold for 9 s. 8 d. I demand whether
I gain or lose, and how much *per Cent.*?

facit 93 l. 6 s. 8 d. *Gain.*

A Draper hath a Piece of Cloth containing
30 Yards, cost him 14 s. the Yard, and another
Cloth containing 19 Yards, cost 7 s. the Yard,
and

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and he sells them one with another for 13 s. the Yard : I demand whether he doth gain or lose, and how much *per Cent.*

*1 $\frac{7}{7}$ facit gains per Yard.
facit 15 l. 3 s. 9 d. $\frac{3}{4}$ $\frac{5}{7}$ gains per Ell.*

If 1 Yard cost 3 s. ready Money, and is sold again for 3 s. 4 d for 8 Months : I demand how much is gained *per Cent. per Ann.* without Interest upon Interest ?

facit 16 l. 13 s. 4 d. Gains.

If 1 Yard cost 9 s. ready Money, and is sold for 8 s. the Yard for 16 Months, the Question is, How much is lost *per Cent. per Annum*, without Loss upon Loss ?

*facit 11 l. 2 s. $\frac{2}{3}$ for 16 Months
lost—8 l. 6 s. $\frac{1}{2}$ for 12 Months*

If I buy Cloth for 6 s. a Yard for 8 Mon. and sell the same again for 5 s. 6 d. ready Money, how much do I lose *per Cent. per Annum* ?

Questions of this Nature are to be resolv'd at two Workings by the Rule of Three, thus:

If 6 s. lose—6 d.—what 100 l.
facit 2000 d.

If 8 Months lose—2000 d.—what 12 Mon.
facit 12 l. 10 s

If I buy Cottons for 3 s. a Yard for 5 Months, and sell them again for 3 s. 2 d. ready Money ; The Question is, How much I gain *per Cent.* allowing 6 *per Cent.* Interest ?

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First, See what they cost in ready Money.

Thus:

$$\begin{array}{r}
 102 \text{ l.} \text{---} 10 \text{ s.} \text{---} 100 \text{ l.} \text{---} 3 \text{ s.} \\
 \text{facit } 2 \text{ s. } 11 \text{ d. } \frac{2}{1} \\
 2 \text{ s.} \text{---} 11 \text{ d. } \frac{2}{1} \text{---} 2 \text{ d. } \frac{3}{4} \text{---} 100 \text{ l.} \\
 \text{facit } 8 \text{ l. } 3 \text{ s. } 10 \text{ d. } \frac{2}{3} \text{ Gain per Cent.}
 \end{array}$$

A Grocer doth sell Cloves, for 4 s. *per lb.* ready Money: The Question is, how long time he must demand, when he doth buy the same Cloves 3 s. 8 d. the Pound, to Gain 13 l. *per Cent.* *per Annum*, without Gain upon Gain, at 6 *per Cent.* Interest.

First, See what the Gain is, if bought at 3 s. 8 d.

Thus:

$$3 \text{ s.} \text{---} 8 \text{ d.} \text{---} 4 \text{ s.} \text{---} 100 \text{ l.}$$

facit 109 $\frac{1}{11}$

Here is gained but 9 l. $\frac{1}{11}$, but he must Gain 13 l. that is, 3 l. $\frac{1}{11}$ more, which must be gained by time: Therefore say,

$$\text{If } 6 \text{ l.} \text{---} 12 \text{ Mo.} \text{---} 3 \text{ l. } \frac{1}{11}$$

facit 7 Mo. $\frac{1}{11}$

A Linnen Draper hath several sorts of Cloth, viz. 470 Ells at 2 s. 10 d. *per Ell* ready Money, 730 Ells at 2 s 6 d. *per Ell* ready Money, and 179 Ells at 3 s. 10 d. *per Ell* ready Money, and he sells the Ell one with another for 2 s. 2 d. to be paid $\frac{1}{2}$ at 5 Mon. $\frac{1}{4}$ at 6 Mon. and the rest at 9 Mon. Interest at 6 l. *per Cent.* I demand what is lost *per Cent.*

$$\begin{array}{r}
 \text{Ells.} \\
 \begin{array}{ccc}
 \text{s.} & \text{d.} & \\
 470 & \{ & 2 \text{---} 10 \\
 730 & \{ & 2 \text{---} 6 \\
 179 & \{ & 3 \text{---} 10
 \end{array}
 \end{array}$$

is

$$\begin{array}{ccc}
 \text{l.} & \text{s.} & \text{d.} \\
 \{ & 66 \text{---} 11 \text{---} 08 \\
 \{ & 91 \text{---} 05 \text{---} 00 \\
 \{ & 34 \text{---} 06 \text{---} 02
 \end{array}$$

1379 Ells cost

$$192 \text{---} 02 \text{---} 10$$

713 Ells sold at 2 s. 2 d. is 149 l. 7 s. 10 d.

Which

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Which Sum being to be received as abovesaid, will by Rebate at $6\frac{1}{2}$ per Cent. come to no more than 144 l. 17 s. 4 d. Then say,

If 192 l. 2 s. 10 d. 100 l. 144. 17 s. 4 d.
facit 24 l. 12 s. per Cent. Loss.

The second Head.

To know how a Commodity must be sold to gain or lose so much per Cent.

If 1 lb. of Nutmegs cost 9 s. 2 d. how much must it be sold for to gain 6 l. per Cent.

Let 100 l. be the first Number in the Rule of Three, the Price the second, and 100 l. with the Progradded, or the Loss subtracted, the third Number.

If 100 l. be 9 s. 2 d. price, what 106 l. facit. 9 s. 8 d. $\frac{1}{2}$

If a Barrel of Gunpowder cost 3 l. how must it be sold to lose 9 l. per Cent. ?

If 100 l. ——— 3 l. ——— what 91 l.
facit 2 l. 14 s. 7 d. $\frac{1}{2}$

If 1 Gallon of Sack cost 5 s. 10 d. for how much must it be sold to lose 8 l. per Cent.

If 100 l. ——— 05 s. ——— 10 d. ——— -92 l.
It must be sold for 5 s. 4 d. $\frac{2}{3}$.

If 90 Ells of Cambrick cost 60 l. for how much must one Yard be sold to gain 8 l. per Cent.

It must be sold for 12 s. 7 d. $\frac{1}{2}$

If a Bag of Hops, weight 16 C. 1 qr. 12 lb. cost 27 l. 6 s. 8 d. for how much must the C. weight be sold to lose 8 l. per Cent.

facit cost per C. 1 l. 13 s. 3 d. $\frac{1}{2}$
Sold to loss per C. 1 l. 10 s. 8 d. $\frac{1}{2}$

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A Sugar Baker hath 737 *lb.* of Sugar that cost 13 *d.* a Pound, and 137 *lb.* 12 *d.* a Pound; I demand how he must sell the Pound one with another, to gain 9 *l.* *per Cent.* First see what one Pound cost

facit 12 *d.* $\frac{714}{8/3}$

It must be sold for, to gain 9 *l.* *per Cent.*

1 *s.* 1 *d.* $\frac{21482}{21825}$.

If a Pound of Mace cost 8 *s.* how must it be sold to gain 24 *l.* *per Cent.*

facit 9 *s.* $\frac{2}{3}$

If 5 Yards cost 5 *l.* ready Money, for how long time must it be sold for 95 *s.* to lose 20 *l.* *per Cent.* without Loss upon Loss?

If I lay out 100 *l.* ready Money, and must receive but 95 *l.* there is 5 *per Cent.* Loss; but I must lose 20 *l.* *per Cent.* that is, 19 *l.* more, so that I must sell my Goods, as if I sold that which cost me 100 *l.* for 80 *l.* Therefore see in what time 80 *l.* will amount to 95 *l.* at 6 *per Cent.* and that will answer the Question.

If 100. lose 6 *l.* in 12 Mo. in what time shall 95 *l.* lose 15 *l.*?

If 100 *l.* $\frac{1}{1}$ Or thus, $\frac{6}{1}$ $\frac{1}{1}$ — 80 *l.*

facit 4 *l.* 16 *s.*

4 *l.* $\frac{1}{1}$ — 16 *s.* $\frac{1}{1}$ — 12 $\frac{1}{1}$ — 15 *l.*

If 1 *lb.* cost 23 *d.* ready Money, for how long time must it be sold for 25 *d.* to gain 11 *l.* *per Cent.* *per Annum* at 6 *per Cent*

Suppose I sell for 12 Months time, then I gain the Price 8 *l.* $\frac{1}{3}$.

As

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As thus.

If 23 d. ————— 100 l. ————— 25 d.
facit 108 $\frac{16}{25}$.

But I must gain 11 l. that is, 2 $\frac{2}{3}$ more; therefore this must be gained by Time:

Thus:

6 l. ————— 12 Mon. ————— 21 l. $\frac{2}{3}$.
facit 4 Mon. $\frac{34}{8}$

This 4 Mon. $\frac{34}{8}$, must be subtracted from 12 Months, and the Remainder is the Answer to the Question.

facit 7 Mon. $\frac{5}{8}$.

If 1 Yard cost 2 s. 9 d. ready Money, at what rate must it be sold for 3 Months $\frac{1}{2}$, to lose 8 l. *per Cent.*?

First, see what Rate it must be sold for in ready Money to lose 8 l. *per Cent.*

Thus:

100 l. ————— 33 d. ————— 92 l.
facit 30 d. $\frac{2}{3}$.

If 30 d. $\frac{2}{3}$ be a ready Money Price, I must sell it for no more, in regard I must stay 3 Mon. $\frac{1}{2}$ for my Money: Therefore let 100 l. be your first Number, and 100 with the Interest for 3 Mon. $\frac{1}{2}$ be the second Number, and the last *facit* your third Number thus:

100 ————— 101 l. 15 s. ————— 30 d. $\frac{2}{3}$.
facit 30 d. $\frac{2}{3}$.

A Mercer buyeth Silk at 14 s. a Yard for 7 Months; at what Rate must he sell it again for ready Money to gain 16 *per Cent.* without Gain upon Gain?

I 5 First

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First; see what the Yard is worth in ready Money, thus:

$$103 \text{ l.} \text{---} 10 \text{ s.} \text{---} 100 \text{ l.} \text{---} 14 \text{ s.} \quad \text{facit. } 13 \text{ s. } \frac{20}{107}.$$

$$\text{Then say, if } 100 \text{ l.} \text{---} 13 \text{ s. } \frac{18}{107} \text{---} 116 \text{ l.} \quad \text{facit } 15 \text{ s. } \frac{14}{107}.$$

The third Head.

When there is gained or Lost per Cent. to know what the Commodity cost.

Example.

If 10 Yards of Cloth be sold for 16 s. per Yard, and there be 6 l. 10 s. Loss per Cent. the Question is, How much the 10 Yards cost?

First, subtract the Loss from the 100 l.

$$6 \text{---} 10$$

$$\text{---} 93 \text{---} 10$$

2. Let the Remainder of 100 l. when there is Loss; and the Gain added to 100 l. when there is Gain, be the first Number; let the Price be the second Number, and 100 l. the third.

$$\text{If } 93 \text{ l. } 10 \text{ s.} \text{---} 8 \text{ l.} \text{---} 100 \text{ l.} \quad \text{facit } 8 \text{ l. } 11 \text{ s. } \frac{2}{7}$$

If 20 Pound of Cloves be sold for 7 s. the Pound, and I gain 9 l. per Cent. The Question is, How much the whole 20 lb cost me?

$$7$$

$$\text{---} 14 \text{ l. } 0$$

$$109 \text{ l.} \text{---} 7 \text{ l.} \text{---} 100 \text{ l.} \quad \text{facit } 6 \text{ l. } \frac{14}{113}.$$

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If I sell 28 Ells of Cloth for 4*s.* *per* Ell, and thereby lose 24 *per Cent.* I demand what the whole Piece cost?

76 *l.*—112*s.*—100 *l.*

facit 7 *l.* 7*s.* $\frac{7}{2}$

If 13 C. $\frac{1}{2}$ of Indico be sold for 36 *l.* and I gain 13 *l.* *per Cent.* I demand how much the C. weight cost?

113—36—100

facit 32 *l.* $\frac{14}{173}$

If 276 Fother of Lead, each 19 C. $\frac{1}{2}$ be sold for 256 *l.* at 5 Mo. and I gain 11 *per Cent.* *per Annum.* The Question is, How much the whole cost ready Money?

$12\frac{5}{12}$ —156—100

facit 244 $\frac{8}{35}$

The Fourth Head.

If by *Wares* sold at such a Rate there is so much gained or lost *per Cent.* how to know what would be gained or lost, if sold at another Rate.

Example.

If Cloth sold at 8*s.* the Yard be 10 *per Cent.* Profit; what Gain or Loss *per Cent.* should I have had, if sold at 7*s.* *per* Yard?

In *Questions* of this Nature, let the first Price be the first Number, 100*l.* with the Profit added or Loss subtracted, the second Number, and the other Price the third Number.

Example.

If 8*s.*—110 *l.*—7*s.*

facit 96 *l.* $\frac{1}{4}$

lost *per Cent.* 3 $\frac{1}{4}$

If one Gallon of Wine be sold for 9*s.* and I lose *per Cent.* how much shall I gain or lose when 3 Gallons are sold for 25*s.* 10*d.*

If 27*s.*—92 *l.*—25*s.*—10*d.*

facit 11 *l.* $\frac{7}{16}$ *per Cent.* Loss

1 6

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If 10 Yards be sold for 4 *l.* 10 *s.* and I lose 12 *per Cent.* what shall I gain or lose if I sell the same for 9 *s.* 9 *d.* per Yard?

9 *s.* ——— 88 *l.* ——— 9 *s.* 9 *d.*

facit 4 *l.* 3 *Lojs* per *Cent.*

CHAP. XXV.

OF ALLIGATION. TION.

1. **A**lligation is so named, because it teacheth to knit or bind together divers Things of unequal Prices, whereby to find how much of each must be taken according to the Question propounded.

It is commonly divided into two Parts, *viz.*

Alligation Medial, and

Alligation Alternate.

II. *Alligation Medial* simple in itself, is no more than to discover or find out a common Medium, Rate, Price, or Proportion in the Mixture of divers Things together, which is performed by reducing the several Prices to one Denomination.

Then multiply the Quantity of each Parcel by its Price, and add all the Products together, the which Total divide by the Number of all the Parcels that are to be mixed, and the Quotient is the Answer to the Quotient demanded. For,

As the whole Quantity is to the whole Price; so is 1 to its own Price.

Example.

Example.

A Meal-man hath several sorts of Meal of several Prices, and would mix them so, that the Quantity mixed might be one common Price, viz.

$$\left. \begin{array}{l} 3 \\ 4 \\ 6 \end{array} \right\} \text{Bushels at } \left\{ \begin{array}{l} 3s. 5d. \\ 5s. 6d. \\ 4s. 8d. \end{array} \right\} \text{a Bushel.}$$

Now the Question is, What one Bushel of this Mixture is worth?

Bush. s. d.	Bush. s. d.	Bush. s. d.	Bush. s. d.
3 at 3—5	4 at 5—6	6 at 4—8	
3	5	4	5. d. Bush.
—	—	—	10—3—
9	20	24	22—0—
1	2	3	28—0—
0—3	—	1	—
—	22 s.	—	6 0—3—13
10 s.—3d.	28	—	—
l.	s. d.	3 l. 0 s. 3 d.	

13—3—0—3—1
facit 4 s. 7 d. $\frac{2}{3}$ per Bushel.

A Hestler mixed Provender for Horses, viz.

$$\left. \begin{array}{l} 5 \\ 3 \\ 2 \\ 4 \end{array} \right\} \text{Bushels of } \left\{ \begin{array}{l} \text{Oats} \\ \text{Oats} \\ \text{Malt} \\ \text{Beans} \end{array} \right\} \text{at } \left\{ \begin{array}{l} 3—6 \\ 4—8 \\ 2—2 \\ 5—3 \end{array} \right\} \text{Bush.}$$

The Question is, What 1 Peck of this Mixture is worth?

Bush. s. d. Bush. s. d. Bush. s. d. Bush. s. d.
 5 at 3—6. 3 at 4—8. 2 at 2—2. 4 at 5—2
 Reduce each Quantity into Pecks, each Price in-
 to Pence, and multiply one by the other: Then
 say as before,

If 56 Pecks—682 d. 1 Peck facit 12 d. $\frac{2}{3}$
How

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How to prove Alligation Medial.

Compare the total Value of the several Mixtures with the Value of the whole Mixture, and if they come both alike, the Work is true; as in the former Example may appear.

	s.	d.	l.	s.	d.
5	3	6	0	17	6
3	4	0	0	14	0
2	2	0	0	4	4
4	5	3	1	01	0
	2—16—10				

Bushels at

(1
8 10
682 515
x22

x 2—16—10

An Alehouse-keeper mixeth 3 sorts of Ale together viz 15 Gall at 4d. $\frac{1}{2}$ per Gall. 22 Gall. at 5d. per Gall 20 Gall. at 6d. per Gall. The Question is, What one Gallon of this Mixture is worth?

facit 5d. 0q. $\frac{1}{3}$

A Refiner having 10 lb of Silver Bullion of 8 Ounces fine, 12 lb of 6 Ounces fine, and 11 lb of 9 Ounces fine, is desirous to melt all together, and to know of what Fineness a Pound weight of this Mals shall be?

lb.	lb.	lb.	
10	12	11	11
8	6	9	12
			10
80	72	99	99
			33
33	251	1	251
			facit 7 oz. $\frac{2}{3}$ fine.

Or

Or thus.

$$\begin{array}{r} 10 + 12 + 11 = 33 \\ 10 \times 8 = 80 \\ 12 + 6 = 72 \\ 11 + 9 = 99 \end{array}$$

Note that a + thus doth signifie Addition, and two lines thus = Equality or Equation, but a X thus, Multiplication.

Then say,

$$\text{If } 33 \text{ — } -251 \text{ — } 1 \\ \text{facit } 7 \text{ oz. } \frac{2}{3} \frac{2}{3} \text{ fine.}$$

III. It will be necessary here to acquaint you, that as Silver is estimated 12 ounces to the Pound, and 20 penny weight to the ounce ; so an ounce of Gold is divided into 24 parts called Carets. Now Refiners, Goldsmiths, and Mint-masters, do distinguish the differing fineness of either, according as it endureth the fire. As for example, an ounce of Gold being tried leleth 3 Carets, it is estimated 21 Carets fine ; if it leleth 10 penny weight, it is esteemed 11 ounces and 10 penny weight fine, &c.

A Goldsmith is to melt 9 lb. 4 $\frac{3}{4}$ $\frac{3}{4}$ of Gold Bullion of 16 Carets fine, with 7 lb. 6 $\frac{3}{4}$ of 22 Carets fine ; the question is, how many Carets fine a pound of this mixture is worth ?

Reduce them into $\frac{1}{2}$ ounces, and work as before.

facit 18 Carets $\frac{1}{4}$ fine.

Or thus,

$$\begin{array}{r} 225 + 16 \text{ — } 3600 \\ 180 + 22 \text{ — } 3960 \end{array}$$

Then say,

$$\text{If } 405 \text{ — } 7560 \text{ — } 1 \text{ facit } 18 \text{ Car. } \frac{1}{4} \frac{1}{4} \text{ fine.}$$

A Mint-master hath 60 lb. weight of Gold of

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of 23 Carets fine, and 80 ^{lb.} weight of 19 Carets fine; the Question is, whether there ought any Alloy to be mixed with it to make a pound of this Mixture to be 21 Carets fine?

An Alloy is a Mixture of some baser metal, as Copper, &c. to moderate the fineness of it

23	19	1380	60
60	80	1520	80

1380	1520	2900	140
140	2900	1	facit 20 $\frac{1}{2}$ Carets.

fine; but it should be 21 Carets fine.

Wherefore I conclude this Mixture is not fine enough by $\frac{1}{2}$ of 20 Carets fine; therefore no Alloy is to be used, but more Gold to be put in.

The Second Part of the Rule of Alligation.

1. The former Rule required only a common rate or price from the whole of several quantities mixed together, but this requires a Price and Quantity in general, composed of such particulars as the Mixture is to be made of. and the parts to be taken proportionably according to the Price, Quantity, or Quality of each other.

Example

A Tobacco-nift having several sorts of Tobaccoe, as some of 2 s. a pound, others at 3 s. a pound, others at 6 s. a pound, and the best at 7 s. a pound. and is desirous to mix 112 pound together, so that he might sell the whole mixture for 4 s. a pound; the question is, what quantity of each must be taken to make up this mixture.

In order to the working of this Question, and others following.

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First set down the common number (or price) proportioned (towards the left hand) which is 4*s*. and likewise the prices given, viz. 2*s*. 3*s*. 6*s*. 7*s*. thus orderly one under another, as you have learned in Addition.

$$\begin{array}{r} 2 \\ 4 \} 3 \\ 6 \\ 7 \end{array}$$

2. Observe what sums are greater and what are lesser than the common number, and couple a great and a lesser together, by making a Semicircle from one to the other: for two greater or two lesser cannot be mixt together, because two lesser being thus taken, can never make so many as the common number, and two greater will be two many.



3. Having thus linked them, observe what the difference is between each of the greater Sums, and the common price; the which difference is set directly against his fellow, which is linked with him.



Then likewise mark the difference between the lesser numbers, and the common number, and set each difference thereof against that which is linked with it.



Lastly, add all the differences into one Sum, which ought to be the first number in the Rule of Three; and the whole equantity to be mixed the second, and each particular Difference the third



Ch. XXVI. T and so is mixed Fe porti and T whole here 2. its ov total Sum A viz. 1 make

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Then work these according to the Rule of Three, and the fourth number will declare the exact proportion of the Mixture.

For as the whole difference is to the whole quantity so is each particular difference to each particular mixed

8—112—3 *facit* 42 of the first sort.
 8—112—2 *facit* 28 of the second.
 8—112—1 *facit* 14 of the third.
 8—112—2 *facit* 28 of the fourth.

112

To prove this and the like questions, multiply the whole quantity mixed by the common price, as, here 112 by 4 *facit* 448.

2. Multiply all the particular quantities found by its own price, as 42 by 2, 28 by 3, &c. and if the total of all the Products agree with the former Sum (448) your work is well done.

A Vintner hath 4 sorts of Wine of several prices, viz. some of 15 *d.* a Gallon, 17 *d.* a Gallon, 19 *d.* a Gallon, and 23 *d.* a Gallon; of which he is minded to mix the quantity of 32 Gallons. The Question is, how many Gallons he must take of each sort, to make the Gallon worth but 18 *d.*

15 I
 18 17 5
 19 3
 23 I
 10

10—32—	1	facit	Call.
10—32—	5	facit	3 $\frac{1}{2}$
10—32—	3	facit	16
10—32—	1	facit	9 $\frac{1}{4}$
			3 $\frac{1}{5}$

32

A Druggist had 3 sorts of Drugs, one was valued at 4 s. the pound, another sort at 7 s. the Pound, the third sort at 11 s. 2 pence; out of these sorts he made two parcels, either of them to be 30 pound weight, whereof one of them thus mixed to be sold for 9 s. the pound, and the other for 10 s the pound. How many pound must be taken of either sort to make each mixture?

The price propounded in the first proposition is 9 s. and in the other 10 s. Likewise the prices given are 4 s. 7 s. and 11 s. but seeing two of these given prices are lesser than the common price, I cannot proceed to the former example: Therefore I couple the two lesser with the greater, and their differences I set against the greater, and the differences of the greater against the two lesser, then work as before. For as 11 the whole difference, is to 30 the whole quantity, so is 2 the first difference unto 5, and 4 for its quantity.

Proposition 1

Proposition 2.

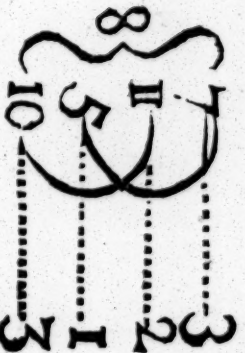
$$\begin{array}{rcl}
 4 & \dots\dots\dots 2 & \\
 \{ 7 & \dots\dots\dots 2 & \\
 \Pi & \dots\dots\dots 2 & \\
 & \dots\dots\dots 58 & 2 \\
 & \dots\dots\dots 4 & \\
 & \dots\dots\dots 1 & \\
 & \dots\dots\dots 1 & \\
 & \dots\dots\dots 6 & 3
 \end{array}$$

11

11

11—30—	2 <i>fa.</i> 5 $r\frac{1}{2}$	11—30—	9 <i>fa.</i> 24 $r\frac{1}{2}$
11—30—	2 <i>fa.</i> 5 $r\frac{1}{2}$	14—30—	1 <i>fa.</i> 2 $r\frac{1}{2}$
11—30—	7 <i>fa.</i> 19 $r\frac{1}{2}$	14—30—	1 <i>fa.</i> 2 $r\frac{1}{2}$

Barley at 7 Groats the Bushel, Wheat at 11 Groats the Bushel, Rye at 5 Groats the Bushel, and Oats at 4 Groats the Bushel, are so to be mixed as 2 100 Bushels of the mixture may be sold for 8 Groats the Bushel : the question is how much must be taken of each sort.



100—	3 <i>facit</i> 33 $\frac{2}{3}$ Barley.
100—	2 <i>facit</i> 22 $\frac{2}{3}$ Wheat.
100—	1 <i>facit</i> 11 $\frac{1}{2}$ Rye.
100—	3 <i>facit</i> 33 $\frac{1}{3}$ Oats.

How much Alloy must I mix with Bullion of 11 ounces $\frac{1}{2}$ fine, to abate the Bullion to 6 ounces $\frac{1}{2}$ fine

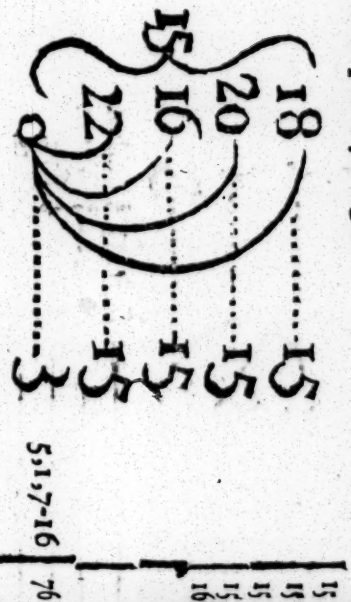
Ounces	Ounces
6 $\frac{1}{2}$	11 $\frac{1}{2}$
0	5 $\frac{1}{2}$

By this Alligation there must be taken 5 ounces and $\frac{1}{2}$ of Alloy, to mix with the 6 oz. $\frac{1}{2}$ of Bullion. A Goldsmith hath 4 sorts of Gold, one finer than another, whereof one is 18 Carets fine, 20 Carets

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16 Carets fine, and the fourth 22 Carets fine. All these he would mix with such an Alloy, as that the whole mixture of 150^{oz}. should be 15 Carets fine; the question is, how much must be taken of each sort

To answer this, and others of this nature, set down as before the Rate demanded at the left hand, and the particulars under one another, and subscribe a Cypher under all for the Alloy unknown, to set the Alloy's difference, which is 15, against all the other Sums, according to the Example. Then work as before, saying, as 76 the whole difference is to 150 the whole quantity, so is each particular difference to the quantity sought.



76—	150—	15	facit	29	$\frac{3}{8}$
76—	150—	15	facit	29	$\frac{3}{8}$
76—	150—	15	facit	29	$\frac{3}{8}$
76—	150—	15	facit	29	$\frac{3}{8}$
76—	150—	15	facit	29	$\frac{3}{8}$
76—	150—	16	facit	31	$\frac{4}{8}$

150

A Refiner has several sorts of Bullion, viz. 30 lb. of 6^{oz}. fine, 6 of 8^{oz}. fine, 12 lb. of 9^{oz}. fine; and he would so mix them together, that a pound thereof

thereof should bear 6 ounces fine. The demand is, whether any Alloy ought to be mixed with it, and how much?

First, see by Alligation Medial what fineness an ounce of this mixture will bear when mixed together then work as in the last question have one.

30	16	12	180	30
6	8	9	128	16
180	128	180	180	12
		416		58

(0
 1
 180 (1
 88 (7 oz. $\frac{1}{2}$

Therefore it is manifest that Alloy must be mixed to Alloy from 7 oz. $\frac{1}{2}$ to 6 oz. which is to be done thus; and you will find for every 6 ounces of Bullion he must take 1 oz. $\frac{1}{2}$ of Alloy to mix with it.

$$\begin{array}{r} 6 \{ 7 \frac{1}{2}) - 6 \\ \quad \quad \quad - 1 \frac{1}{2} \\ \hline \quad \quad \quad 7 \frac{1}{2} \end{array}$$

CHAP. XXVI.

Of Instructions for measuring of any Superficies, Board, Glass, Hangings, Pavements, &c.

Observe that Board and Glass are usually measured by the Foot, and the Foot containeth 144 Inches.

There

There is a Table 24 Foot in length, and 3 foot wide. I demand how many foot is contained therein?

The Rule is,

Multiply the length by the breadth, and the Product giveth the content of the whole.

$$\begin{array}{r} 24 \\ \times 3 \\ \hline \text{facit } 72 \text{ foot.} \end{array}$$

There is a Table of 20 foot 9 inches long, and 3 foot 8 inches broad; how many foot doth it contain.

Reduce them into Inches, and multiply as before; then Divide their Product by 44 (the Square Inches in a foot) the *Quotient* is the *Answer* in Square or Superficial feet?

$$\text{facit } 76 \text{ foot } \frac{2}{5}.$$

How to measure Glafs.

There is a house hath 26 panes of Glafs in the Window, each pane being 2 foot 3 inches long, and 18 inches wide. The question is, how many foot of Glafs is contained in all?

$$\text{facit } 87 \text{ foot } \frac{1}{4}$$

Pavements and Hangings are usually measured by the Yard

One Yard in length is 3 foot.

One Yard square upon the Superficies is 9 foot.

How to measure Pavements.

There is a piece of Ground to be paved containing 49 yards in length, and 31 yards in breadth ; how many yards are contained therein ?

facit 1519 yards.

A Gentleman had his Door paved, beirg 37 yards 2 foot, one way, and 7 yards 1 foot, the other way ; I demand how many yards are there in all ?

facit 276 yards $\frac{2}{3}$.

A Suit of Hangings 45 yards $\frac{1}{2}$ long, and 2 yards $\frac{1}{4}$ broad ; how many yards are there in all ?

Divide by 16, because 16 quarters is one yard square.

facit 102 yards $\frac{3}{8}$

Instructions for the measuring of Solids, as, Timber and Stone, &c.

12 inches is one foot, in length.

144 inches is one foot square, superficies.

1728 inches is one foot, solid.

There is a Stone of 4 foot long, 3 foot broad, and 2 foot deep ; I demand how many square foot is contained therein ?

The Rule is

Multiply the three Dimensionous one into another, and the Product is the Answer.

facit 24 Foot.

A Stone of 5 Foot 9 Inches long, 4 Foot 7 Inches broad, 2 Foot 8 Inches deep ; I demand how many foot there is contained in the said Stone ?

Reduce all the Dimensions into Inches, and divide by 1728.

facit 70 Foot $\frac{7}{8}$

K *H. 20*

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How to measure Timber.

A Piece of Timber 20 Foot 8 Inches in length, 2 Foot 5 Inches broad, and 2 Foot thick ; how many Foot doth it contain ?

A Country-man borrow'd of his Neighbour a Stack of Hay, the Content whereof was 40 Foot square : — When the time of Payment came, he told his Neighbour, he could not pay him all together, but he would pay him 20 Foot square at that time, and 20 Foot square more at another time afterwards, which he performed. The Question is, Whether he paid the whole Quantity borrowed, or what was wanting thereof ?

40	20
40	20
1600	400
40	20
64000 borrowed	8000 full Time
	Paid 8000 2d. Time
	16000 paid.

So that he paid but one quarter of the Quantity he borrowed.

There any many things of this nature, that might be brought in under these two heads, which are more difficult, as the measuring of Land of several forms, and the Measuring of Timber, Stone, or other things not equally squared ; the well managing whereof would require a *Treatise* of it self, which I omit, in regard it doth not so much concern my Practice, nor my Intention in this Tract ; but I judge this sufficient for the present.



PROE M.

FOR the Satisfaction of the Curious, as well as the Advantage of the Learner, I have here added this Chapter as well as others, to the Works of the Author; in order to Render this Manual of Arithmetic so Perfect and Complete that nothing may be wanting, that may be either pleasant to the Reader, or serviceable to the Publick.

1. * THE Rule of *Position*, being *Arithmetically* Consider'd, implies a Foundation upon which Reason and Analogy is built. It is also call'd The Rule of *False*, because that by the help of false Suppos'd Numbers, we find the *Truth*; And not (as some imagine) that in its self is really Erroneous.
2. This Rule hath two Parts Observable, *viz. Single* and *Double*.

SECT. I. *Single Position*.

3. In *Single Position*, there is always Suppos'd one Number, in order to find out the true Number sought; or which is the same in Effect, we make but

but one *Supposition*, with which working, as with a true Number, we thereby Regulate and Discover (by way of Analogy) the true *Answer* Sought, according to the following R U L E.

As the *Total* arising from the Error, to the True *Total* :: So is the Supposed, Part, to the True One.

Example. I.

1. 2. A Gentleman hath Three Sons, *viz.* A. B. and C. unto whom he Bequeaths 10000 *l.* in such manner, that B. shall have twice as much as A. ; And C. three times as much as B. To know their several Legacies

See the Work.

Suppose $\left\{ \begin{array}{l} A - 5000. \\ B - 1000. \\ C - 3000. \end{array} \right.$

Summ. - 4500.

l. s. d. q. p.
If 4500 *l.* : 10000 *l.* :: $\left\{ \begin{array}{l} A. 5000 \text{ fa. } 1111-02-02-02. 66 \\ B. 1000 \text{ fa. } 2222-04-05-01. 32 \\ C. 3000 \text{ fa. } 6666-13-03-03. 96 \end{array} \right.$

Proof - - - 9999-19-11-03. 94†

Explication.

I. IN *Example* first, there is Supposed for A's Legacy, 5000 *l.* then it follow's, that B. Receiving twice as much as A, must have 10000 *l.* ;

And

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And C. Receiving three times as much as B. must have 3000*l.* whole Summ is 4500*l.*; which should be 1000*l.* the whole Summ Bequeath'd. Now from this *false Supposition*, the true Part of A. *Est.* sought, may be readily found, by the Rule of Three Direct; thus : If 4500*l.* should be 1000*l.* what 500*l.*? *Ans.* 111*l.* -- 2*s.* -- 02*d.* -- 02*q.* 60 *Parts* for A. whose Double, is B's Part; and the 3 triple of B's Part, when found, shall be C's Part. Or B and C's Part severally, may be found, as above by making each of their particular Parts; proceeding from the *Supposition*, made for A. (*viz.* B. 1000*l.* and C. 3000*l.*) the third Term in the Rule of Three; as Appears in the Work, which see.

Example. II.

2. Three Brethren, *viz.* A. B. and C. devising of their Ages : B. said his Age was twice and $\frac{1}{2}$ the Age of A. And C. said he was thrice and $\frac{1}{4}$ the Age of B. And that the Summ of all their Ages, was 115 Years : To know their Ages respectively

See the Work.

Years.

$$\text{Suppose } \begin{cases} A. \dots 20 \\ B. \dots 50 \\ C. \dots 160 \end{cases}$$

$$\text{Summ.} \dots 230 \text{ Years.}$$

Years. Years.

$$\begin{cases} A. 20 : \text{saith } 10 \\ B. 50 : \text{saith } 25 \\ C. 160 : \text{saith } 80 \end{cases}$$

Then if 230 : 115 :

$$\text{Proof} \dots \dots \dots 115 \text{ Years.}$$

EXPLICATIO N.

II. IN *Example 2.* You Suppose for *A*'s Age, any Number of Years, at pleasure; which is here imagin'd to be 20 Years; then it follow's that *E*'s Age, according to the Question, must be twice and $\frac{1}{2}$ that of *A.* (*viz.* 50 Years) And *C*'s Age, being thrice and $\frac{1}{3}$ that of *B.* (*viz.* 160) their Summ is 230 Years, For the *Total* arising from the *Error*; which in *Single Position*; is always made the 1st Term in the *Rule of Three*: The true *Total* given, the 2d: And each of the Supposed Parts, the third; in order to find (at three Operations) the true *Answer* for each of the Parts sought; which are here, 10, 25, and 80 Years, for the Ages of *A.* *B.* and *C.* severally. See the Work of the Second *Example* above.

Questions *Propounded for the LEARNER'S Exercise and Improvement.*

Example III. Q. 3. Three Men, *viz.* *A. B.* and *C.* Occasionally spends at a Reckoning a Guinea or 21 Shillings, whereof *A.* pays $\frac{1}{2}$, *B.* $\frac{1}{3}$ and *C.* $\frac{1}{4}$; What must each Man pay, According to that Proportion? *Answer.*

Example IV. Q. 4. Admit a Purchase of Land is made by three Persons, *viz.* *A. B.* and *C.* for 8756 *l. Sterling*; whereof, *A.* pays a certain Summ unknown, *B.* pays $\frac{2}{3}$ that of *A*; and *C.* $\frac{1}{4}$ that of *B*: To know each Man's Part of the Purchase? *Answer.*

Example V. Q. 5. A Gentleman Bought a Chaise, Horse and Harness for 80 *l.* the Horse came to twice the Price of the Harness, and the Chaise to thrice

thrice as much as both Horse and Harnes; what did he give for each? *Answer.*

Example VI. Q 6. A Wine-Merchant hath a Cellar or Vault, which contains three Sorts of Wine; viz. Mountain, Claret and Rhenish: Now it happens that the Mountain is just $\frac{1}{2}$ the Claret; and the Claret $\frac{1}{3}$ the Rhenish; and all of them to consist of 84 Hogheads: To know how many there are of each sort? *Answer.*

OBSE R V A T I O N S.

Remark I. Note, As Single Position hath always One of the Numbers Sought, Supposed or Imagined; So Care must be taken, that all the Rest must (in their Regulation) have a Dependence upon that; according to the Nature of the Question.

Remark II. Note, In all Examples of Single Position there are always given, a true Total, for the Number's sought, in order to find each of them in particular, according to the same Ratio or Proportionality that the Total of the Errors hath to the Supposed One, and its Dependants.

Remark III. Note, The LEARNER observing carefully, the Work of the two first Examples, and their Explication will thereby be enabled to Perform readily, the other Four; Or any other Comprehended in this Rule.

S E C T. II. Double Position.

1. Double Position hath its Signification contained in the very Term; which implies any two Supposed Number's; each of them being so orderly

Pac'd

Plac'd and Dispos'd with their Subsequent *Errors*, that the true Number sought, is thereby Discovered by a particular manner of Working; according to the Nature of the Question. Whence it is, that this *Rule* tho' grounded upon False, Negative, or Suppositious-Numbers, are render'd Useful, in Solving many curious Questions, even to Admiration.

• 2. In this *Rule*, You are to find the true Number sought; by supposing any Number, at pleasure whether great, or small; And having made Trial of it Resolve the Question without any *Error*; if so, it is the true Number Sought; if not, You are to *Note* by some proper Sign what *Error* is at the End of the *Work*: And whether it be too much or too little; if too much, mark it thus +, but if too little; thus—.

Then Suppose again, another Number (it imports not, whether it be nearer or further off) and try, as before; and mark that *Error*, also. And then according to.

RULE I.

Multiply Crosswise the first *Position* by the second *Error*; And the Second *Position* by the 1st. *Error*; (And if the *Error* be both +, or both—) Subtract the Lesser *Product* from the Greater; and Divide the Remainder or *Dividend*, by the Difference of *Errors*; the *Quotient* of that *Division*, is the true Number Sought.—But if the *Errors* are unlike; (that is, the One too much, Marked +; And the other too little, marked —) the Summ of these *Products*, must be Divided by the Summ of the *Errors*, the *Quotient* will be the true Number Sought; exactly *Answering* all the Demands of the Question; Or, otherwise the same may be readily Effected, as follows, by

RULE

RULE II.

The *Suppositions* and their *Errors*, being so orderly Placed and Disposed, with their proper Signs, as above, you may then proceed to Effect it, by the *General Rule*, in the way of *Proportion* or *Analogy*; thus,

As the Difference of the *Errors*, if alike, or their Summ, if unlike, to the Difference of their *Suppositions*: So either *Error*, to a fourth Number; which accordingly Added to, or Subtracted from the *Supposition* against it, will Answer the Question.

Example. 1. Q 1. A man is to Drive 48 young Turkeys 40 Miles; And for every Turkey, which comes alive to the End of the Journey, he is to Receive 3 d.; but for every One which dyes by the way, he is to pay 6 d. At the End he Received 72 d. How many Dyed by the way? *Answer* 8 Turkeys.

See the Work.

Suppositions.

Errors.

1. --- 12 --- --- 36 *Prod.* -- 216 - 18 + 12
2d. --- 6 --- --- + 18 *Prod.* -- 216 - 36 + 6

Summ, or Divisor -- 54 *Sum* or *D.* 432 (- 8 *Turk.*

Or thus.

Analogy. As 54 the Summ of the *Errors* (because Unlike): To 6 the Difference of their *Suppositions*: So is

--- 36 1st. *Error* } To { *Term* } *T* for *An.*
+ 18 2d. *Error* } { 4 - 12 - 3 }
+ 6 - 3 }

EXPLA

EXPLICATION.

Step I. IN Example I. According to Rule I. the 1st *Supposition*, is imagin'd to be 12 Dead Turkies, at 6 *d.* per piece; which according to the Nature of the Question, amounts to 72 *d.*, which being Subtracted from 108 *d.* the Value of 36 Living Turkies Remaining at 3 *d.* per piece, the Difference is 36 *d.* which being deducted from 72 *d.* the Money he was to Receive at the End of the Journey, there Remains 36 L^{es}s, Noted — 36; because so many Pence less than just.

Step II. Secondly, For the 2^{d.} *Supposition*; Let it be imagin'd that the Dead Turkies, were only 6, at 6 *d.* per piece, make 36 *d.*; which being deducted from 126 *d.* the Value of the 42 Turkies Living, at 3 *d.* per piece; the Remainder is 90 *d.* from which Abate the 72 *d.* due at the End of the Journey; the Difference is 18 *d.* which he receives more than just: therefore the 2^{d.} Error is 18. Noted + 18, because more than just.

Step. III. Thirdly, According to Rule I. Let the Error of the 2^{d.} Position. (viz. 18) be Multiplied by the 1^{st.} *Supposition* (viz. 12) the Product is 216: Also the Error of the 1^{st.} Position (viz. 36) being multiplied by the 2^{d.} *Supposition* (viz. 6) the Product is likewise 216; which must be Added together (seeing the Signs are Unlike) their Summ is 432, for Dividend; which being Divided by 32 the Sum of the Errors, (viz. 36 + 18 — 54) the Quotient is 8, the Number of Dead Turkies sought which may be Proved upon Tryal. See the *Work* above.

Proof. Fourthly, For Probation, The same Example above; may be likewise Effected, by the Rule of Proportion Direct, thus; Let the Summ of the

Error

Errors (viz. 54) be made the 1st. *Term* in the *Rule of Three* ; because the Sums are Unlike ; then it follows, that the Difference of the *Suppositions* (viz. 6) being made the 2^d. *Term* ; And each of the *Errors*, (viz. 36 and 18) the 3^d. *Term* ; the 4th. *Term* or Numbers Sought are severally, 4 and 2 ; which being particularly Subtracted, or Added to their several *Suppositions*, according to their Signs, (viz. $12 + 4 = 8$. And $6 + 2 = 8$) their Difference and Summ, are each of them 8, the Number of Dead Tjries fought. See *Rule II*. Also the Work of the *Analogy* above.

Questions Propounded for the LEARNER'S
Exercise and Improvement.

Example. II. Q. 2. Admit it is Required to make up a *Pound Sterling*, in Shillings and Groats, only in such manner, that the Number of Groats may be to the Number of Shillings; as 7 to 1 : How many Shillings and Groats must there be ?
Answer. 6 Shillings.

facit 42 Groats, and 6 Shillings.

Example. III. Q. 3 A *Whale* is Caught whose Head is 6 foot Long ; the Tail is as long as the Head, and half as Long as the Body ; the Body was just the Length of the Head and Tail : I demand the Length of the Body ? *Answer. 48 feet.*

Example. IV. Q. 4. Suppose a Cistern hath 4 Cocks, which holds 8 Barrels of Water ; And the 1st. Cock will Run it all out in 6 Hours ; the second in 4, the third in three ; And the last in 2 Hours ; in what time shall all of them Run it out ? *Answer in $\frac{4}{5}$ of an Hour.*

Example. V. Q. 5. What Number is that to which, if you Add $\frac{1}{3}$ of its self, and from the Summ Subtract

Subtract $\frac{1}{2}$ of its self; the Remainder will be 532;

Answer 672.

Example. VI. Q6. Concerning the Corrector's Age, &c. In Verse.

WHEN first the Marriage Knot was ty'd,
Betwixt my Wife and me;

My Age with Her's did so Agree,

As Nineteen do's with Eight and Three;

But after Ten, And half Ten Years,

We Man and Wife had been;

Her Age came up as near to Mine,

As two Times Three to Nine.

Now by these Particulars, brave *Artist*, you'll find;
Our Ages at Marriage, if you are so Inclind.

OBSERVATIONS.

Remark I. Note, As in Single Position, So also in Double, Regard must be duly had to the Nature of the *Question*, in Rendering each Error Rationally Agreeable to the Supposition, upon which it depends: For otherwise; if the Error is Erroneously found, the Rest of the Work, will Consequently be false.

Remark II. Note, The Performance of the five Examples above, will not only Illustrate and Apply the Rule, in all its Parts, but also Enable the Learner to Effect any other of the same kind.

Remark III. Note, As this Rule is very Curious as well as Useful; So it is here Compendiously Illustrated, that this Manual of Arithmetic may not only Equalize, but even (in several Respects exceed) those, that are now Extant.

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